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CONTRIBUTORS TO VOLUME I

1920

CRANDALL, FLOYD M., M.D.

FRAZIER, CHARLES H., M.D.

MÜLLER, GEORGE P., M.D.

SPENCER, W. H., M.D.

RUHRÄH, JOHN, M.D.

PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES

EDITED BY

HOBART AMORY HARE, M.D.

PROFESSOR OF THERAPEUTICS, MATERIA MEDICA AND DIAGNOSIS IN THE JEFFERSON MEDICAL COLLEGE,
PHILADELPHIA; PHYSICIAN TO THE JEFFERSON MEDICAL COLLEGE HOSPITAL; ONE TIME CLINICAL
PROFESSOR OF DISEASES OF CHILDREN IN THE UNIVERSITY OF PENNSYLVANIA;
MEMBER OF THE ASSOCIATION OF AMERICAN PHYSICIANS, ETC.

ASSISTED BY

LEIGHTON F. APPLEMAN, M.D.

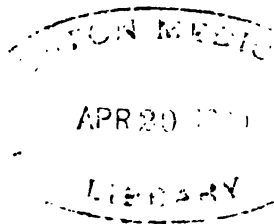
INSTRUCTOR IN THERAPEUTICS, JEFFERSON MEDICAL COLLEGE, PHILADELPHIA; ASSOCIATE PROFESSOR OF
OPHTHALMOLOGY, POLYCLINIC SECTION OF THE UNIVERSITY OF PENNSYLVANIA; OPHTHALMOLO-
GIST TO THE FREDERICK DOUGLASS MEMORIAL HOSPITAL AND TO THE BURD SCHOOL;
ASSISTANT SURGEON TO THE WILLS EYE HOSPITAL

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SURGERY OF THE NECK, HEAD AND BREAST—SURGERY OF THE THORAX, EXCLUD-
ING DISEASES OF THE BREAST—INFECTIOUS DISEASES, INCLUDING ACUTE
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OF CHILDREN—RHINOLOGY, LARYNGOLOGY AND OTOTOLOGY



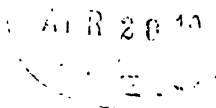
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LIST OF CONTRIBUTORS

CHARLES W. BONNEY, M.D.,
Associate in Topographical and Applied Anatomy in the Jefferson Medical College, Philadelphia.

JOSEPH W. CHARLES, M.D.,
Consulting Ophthalmologist to the Mission Home for the Blind and the Mission Baptist Sanitarium, St. Louis, Missouri.

JOHN G. CLARK, M.D.,
Professor of Gynecology in the University of Pennsylvania, Philadelphia.

WILLIAM B. COLEY, M.D.,
Professor of Clinical Surgery, Cornell University Medical School; Attending Surgeon to the General Memorial Hospital for the Treatment of Cancer and Allied Diseases; Attending Surgeon to the Hospital for Ruptured and Crippled, New York.

FLOYD M. CRANDALL, M.D.,
Consulting Physician to the Infants' and Children's Hospital; Late Visiting Physician to Minturn Hospital, New York.

EDWARD P. DAVIS, M.D.,
Professor of Obstetrics in the Jefferson Medical College of Philadelphia.

CHARLES H. FRAZIER, M.D.,
Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Howard and Philadelphia Hospitals.

ELMER H. FUNK, M.D.,
Associate in Medicine in the Jefferson Medical College, Philadelphia; Medical Director of Department of Diseases of the Chest of the Jefferson College Hospital.

H. RAWLE GEYELIN, M.D.,
Associate in Medicine in the College of Physicians and Surgeons of Columbia University and Associate Attending Physician to the Presbyterian Hospital, New York City.

EDWARD H. GOODMAN, M.D.,
Associate in Medicine, University of Pennsylvania; Assistant Physician, University Hospital and Philadelphia General Hospital; Consultant to the Medical Dispensary, University Hospital, Philadelphia.

H. R. M. LANDIS, M.D.,

Director of the Clinical and Sociological Departments of the Henry Phipps Institute of the University of Pennsylvania; Assistant Professor of Medicine in the University of Pennsylvania; Visiting Physician to the White Haven Sanatorium.

WALTER ESTELL LEE, M.D.,

Surgeon to the Germantown and to the Children's Hospital and to the Out-patient Department of the Pennsylvania Hospital; Assistant Surgeon to the Bryn Mawr Hospital.

GEORGE P. MÜLLER, M.D.,

Associate in Surgery in the University of Pennsylvania; Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the St. Agnes and Polyclinic Hospitals; Assistant Surgeon to the Hospital of the University of Pennsylvania; Consulting Surgeon to the Chester County Hospital.

O. H. P. PEPPER, M.D.,

Assistant Professor of Medicine, University of Pennsylvania, Philadelphia.

JAY F. SCHAMBERG, M.D.,

Professor of Dermatology and Syphilology in the Jefferson Medical College, Philadelphia.

W. H. SPENCER, M.D.,

Assistant Demonstrator of Laryngology in the Jefferson Medical College, Philadelphia.

JOHN RUHRÄH, M.D.,

Professor of Diseases of Children, University of Maryland and College of Physicians and Surgeons School of Medicine.

WILLIAM G. SPILLER, M.D.,

Professor of Neurology in the University of Pennsylvania; Clinical Professor of Nervous Diseases in the Woman's Medical College of Pennsylvania.

ABRAHAM O. WILENSKY, M.D.,

Visiting Surgeon, Beth David Hospital; Adjunct-Attending Surgeon, Mount Sinai Hospital; Assistant in Surgical Pathology, Mount Sinai Hospital Pathological Laboratory.

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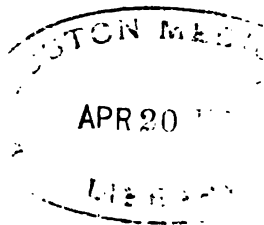
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PROGRESSIVE MEDICINE.

MARCH, 1920.

SURGERY OF THE HEAD, NECK AND BREAST.

By CHARLES H. FRAZIER, M.D.

DURING the past year there has been little progress in the field of neurological surgery, as far as one may judge from available literature. A year ago the majority of surgeons were in the service of the military hospitals or had just received their discharge and their contributions dealt for the most part with the effects and treatment of gunshot wounds of the head and spine. These were reviewed at length in the issue of last March and apparently, so far as concerns the recent war, the last word has been written about the treatment of these injuries. However, the opportunity in the military hospitals to study functional and regional symptomatology, from the standpoint of localization, has not been neglected and in the field of neurology numerous contributions continue to appear, but they will be reviewed by the neurologist rather than the surgeon.

Returning from military to civilian service there has been delay and sometimes confusion in the resumption of practice, and sufficient time has not elapsed as yet for the collaboration and presentation or for the accumulation of data bearing upon the lesions the neurological surgeon encounters in his civilian practice. There is, therefore, scant literature on the subject of brain tumors, meningitis, abscess, the cranial nerves, epilepsy and the like. Consequently, in this number of PROGRESSIVE MEDICINE, the section usually devoted to this field is not as large as usual.

THE BRAIN.

Traumatic Lesions of the Brain and Skull. In the discussion of this subject one so often has to listen to a great deal of loose talk about the part increased systolic pressure plays as an indication for operative intervention—cerebral decompression. I have frequently had to correct the false impression that the blood-pressure, *i. e.*, systolic pressure, always rises in grave forms of intracranial trauma, and I was glad to see in a recent memorandum that Armitage¹ points out the greater importance of the pulse-pressure. Frequently, when the systolic pressure is

¹ Pennsylvania Medical Journal, November, 1919.

not affected, one may find a startling elevation of the pulse-pressure. The normal relationship of the pulse-pressure is as 1:2:3, and in cerebral compression this relationship is enormously distorted. The following are cited as examples:

Diagnosis.	Systolic.	Diastolic.	Pulse-pressure.	Pulse.	Result.
Subdural hemorrhage . . .	160	85	75	60	Recovery
Subdural hemorrhage . . .	150	60	90	65	Death
Contusion	110	60	50	58	Recovery
Depressed fracture	198	63	135	65	Death
Extradural hemorrhage . . .	122	58	64	58	Recovery
Not stated	122	68	54	60	Recovery
Not stated	140	70	70	70	Death
Gunshot wound	220	20	200	60	Death
Subdural hemorrhage	150	65	85	44	Death
Fracture and hemorrhage . .	122	58	64	51	Recovery

From these citations it will be seen that there is a relationship between the pulse-rate and pulse-pressure, and, as the pulse-rate descends, the pulse-pressure ascends, until finally the pulse-pressure becomes greater than the pulse-rate; when this has occurred, compression has always been present, according to Armitage, and he therefore concludes that where we have an increasing pulse-pressure and a falling pulse an operation should be performed without delay. With his conclusion that systolic pressure is too uncertain a factor to be of any value whatever in diagnosing the degree of intracranial pressure, I agree entirely, and he strikes the keynote of the issue when he says that the decision as to whether a patient should be trephined should be determined *after grave reflection and consideration of the entire group of symptoms*. This is the crux of the situation and the only perspective by which to gauge the gravity in a given case. All the factors and signs of increasing intracranial tension must be taken into consideration, particularly the true Cheyne-Stokes phenomena with its rhythmic curve affecting sensation, reflexes, musculature, consciousness as well as the respiratory and circulatory phenomena. If one studies an individual case with this viewpoint and is able to recognize symptomatically the evidence of increasing tension and to interpret the variations from normal, there should be no difficulty in selecting the cases in which an operation is indicated as a means of saving life.

Fractures of the Skull. In his analysis of 75 cases of fracture of the skull treated during the last five years at the Mt. Sinai Hospital, New York, A. Wilensky² brings out some points of interest, particularly with relation to the effects of intracranial trauma and to the indications for surgical intervention. As I have just said, so often writers have stressed the rise in blood-pressure as a warning that something must be done to relieve pressure (meaning a decompression) because, in the classic research of Kocher, the blood-pressure always rose when intracranial pressure was artificially increased. On more than one occasion I have called attention to the inconstancy of this sign in the intracranial trauma as we meet with it in practice, and the figures of Wilensky bear

² Annals of Surgery, October, 1919.

me out in this contention; the average systolic pressure was 110 mm. Hg., the range being 90 to 140 mm. Hg. Much more reliance can be placed upon the pulse-pressure which in this series was 36 mm. Hg. So, too, in the matter of papilledema. Theoretically, one might forecast a papilledema, in the majority if not in all cases, but, as a matter of fact, it does not appear, with few exceptions, early enough to serve as a guide to treatment. In 25 ophthalmoscopic examinations there was a perceptible edema in only 3 cases, and a blurring of the disk in 2. That is, at the most, in only 20 per cent. were the fundus changes suggestive of increased intracranial pressure. The percentage as quoted in this series, which I believe could be supported by observation in the majority of clinics, is quite at variance with that quoted by Kearney, who, in examining Sharpe's cases, reported edematous blurring of the disks in all cases of fracture of the skull within the first twenty-four hours of the injury. There is no doubt in my mind as to which of the two observations is nearer the truth.

The commonest evidences of neurological disturbances were found in the condition of the reflexes. These existed either alone, or as a part of a clinical picture, such as that of a higher focal lesion in which the condition of the reflexes was apparently incidental. The response obtained might be equal or unequal on both sides; might be weaker than normal on one or both sides; or might be similarly exaggerated. These abnormalities of reflexes, in the absence of any other evidences of a focal lesion, had no definite bearing on the total clinical picture, especially from a therapeutic point of view.

As to the propriety of operation, Wilensky states that it has never been considered an absolute rule to make use of this complication as an imperative indication or as a convenient excuse. For practical considerations he classifies his cases into three groups, following the classification I proposed in a former issue of *PROGRESSIVE MEDICINE*: (1) A large group the members of which always recovered spontaneously. These are the essentially mild cases; (2) a smaller group, the individuals of which were almost certain to die with or without operative treatment; (3) a very small group in which the individuals presented such borderline evidence of intracranial damage as to make a policy of watchful waiting advisable, but in whom one should be ready at a moment's notice to operate. Following this policy, the general mortality was 31 per cent., and on operation there was a mortality of 48 per cent. It is interesting to compare these statistics with those of Mixter, who was much less conservative, with a general mortality of 54.1 per cent., and an operative mortality of 43.4 per cent.

I was surprised at Wilensky's conclusions with regard to lumbar puncture. He says that lumbar puncture gives no information of value in the interpretation of the clinical picture and does not subserve a useful purpose from the therapeutic point of view. I believe the recovery of blood-stained spinal fluid is of significance from the medicolegal standpoint, as indicating a lesion serious enough either to fracture the skull or to cause a contusion of the cortex. And there seems to be no doubt but that lumbar puncture, repeated if necessary, will at least relieve

intense headache, and, in a borderline case, may tide over a situation which otherwise might seem to justify a decompression.

COMPOUND FRACTURES OF THE SKULL. In considering the treatment of compound fractures of the skull as met with in civil practice, Sachs³ speaks of the lessons to be learned from the experiences in the war with gunshot wounds of the head, more particularly as to the thorough débridement of the wound. He recognizes, of course, the essential differences between gunshot wounds and the compound fractures of civil life, especially the absence in the latter of imbedded foreign bodies. However, with these and other distinctions, he believes there is an advantage to be gained in the complete excision of traumatized tissue, scalp, dura and brain tissue, in replacing the defect in the dura by a transplanted piece of fascia, and closing the skin incision completely without drainage.

Injury of the Longitudinal Sinus. What proved at autopsy to be a laceration of the longitudinal sinus with hemorrhage into the ventricles, following a fall, gave a rather unusual clinical picture as reported by Vine.⁴ In addition to the subnormal temperature, slow pulse, and unconsciousness, there was intense rigidity of the entire body, the fists were clenched and the forearms flexed across the chest. The kneejerks were exaggerated and the Babinski and Kernig signs were present, with great irritability. The nature of the lesion was not suspected before the operation; at an exploratory craniotomy, the rent in the sinus was discovered in the neighborhood of the anterior fontanelle and plugged with Horsley's wax.

Meningeal Hemorrhages After Contusion of the Skull. The employment of lumbar puncture routinely after cranial injuries of any severity is, I think, good practise. There may be always an element of uncertainty as to the gravity of the lesion and the recovery of blood-stained fluid from the spinal canal implies an injury serious enough to have caused a fracture, or meningeal or cortical hemorrhage. The evidence thus secured may be important at least from a medicolegal viewpoint. Guillain⁵ describes 13 cases in which there was evidence of meningeal hemorrhages following a contusion of the skull, some with, and some without, a scalp wound. In the management of these cases he emphasizes two points: the employment of local anesthesia if an exploratory craniotomy is performed, and the value of repeated lumbar punctures. Too much fluid should not be withdrawn at first, as the reduction of pressure may cause a secondary hemorrhage. Subsequently repeated puncture is of value in relieving pressure and withdrawing the toxic products of hemolysis. While the symptoms are often vague, Guillain has observed bilateral inversion of the plantar reflex, defensive reflexes, some mental confusion and sallowness of the skin.

Hemorrhage of the Newborn. We have referred at one time or another to cerebral hemorrhage of the newborn as a surgical problem and have been of the opinion that in many instances hemorrhage was usually over

³ *Annals of Surgery*, January, 1919.

⁴ *British Medical Journal*, May 3, 1919.

⁵ *Archives Médicales Belges*, Liège, March, 1919, lxxii, No. 3.

both ventricles, if not often more widely distributed. I was somewhat surprised at the statement which Warwick⁶ makes when she says "all authors agree on the predominance of bleeding over the cerebrum, usually limited to one side." In 36 routine autopsies in stillborn children or those dying early in infancy, Warwick found 18, or 50 per cent., with definite hemorrhages. An interesting point brought out by these examinations was the part which intracranial hemorrhage plays merely as an incident of a general hemorrhagic diathesis. This was the case in 8 out of 18 cases. The location of the hemorrhage most concerns the surgeon:

8 surgical:

- 6 cases over one cerebral hemisphere.
- 2 cases in the dura only.

10 non-surgical:

- 3 cases over the cerebral and cerebellar hemispheres and in the dura.
- 1 case over the cerebral and cerebellar hemispheres and in the ventricle.
- 3 cases over the cerebral and cerebellar hemispheres.
- 1 case over the cerebellar hemisphere.
- 2 cases in the ventricles only.

When we come to analyze the series it becomes apparent at once that only 8 cases, at the most, presented surgical problems and if we exclude the 2 cases of hemorrhage in the dura, the number is reduced to 6, or 33 per cent. This percentage corresponds to the views I had hitherto maintained with regard to the surgical applicability of these cerebral hemorrhages. It is in the minority that surgical intervention will avail, and even in these, as has been noted above, the cerebral hemorrhage is only an incident of other pathological processes. The most frequent source of bleeding is rupture of the superficial veins which pass over the surface of the brain into the longitudinal sinus; below the tentorium it is the transverse sinus or its tributary vessels; and in the ventricle, the choroid plexus. From her review of the etiological factors, Warwick concludes that forceps deliveries, prolonged labor, advanced age of the primipara mother and syphilis do not play as important a role in the etiology as formerly supposed.

Hydropneumocranium. Since the first case of air in the ventricles reported by Lockett, there have been but few case reports of pneumocranium, but quite recently Potter⁷ describes an interesting instance in a patient who fell a distance of fifteen feet and struck the forehead. There was no evidence of a serious intracranial injury at the time, but quite accidentally, and some nineteen days after the accident, the first x-rays taken revealed a fracture of the frontal bone, including the internal and external walls of the frontal sinus, and a gaseous accumulation the size of a small hen's egg. Further studies made about five weeks after the injury showed a considerable increase in the volume of air in the chamber and air in the lateral ventricle. At this time a more intensive study demonstrated the presence of fluid in the air chamber. Under the screen, the fluid could be seen to splash with any sudden movement of the head and the splashing was audible. From this time on the air

⁶ American Journal of the Medical Sciences, July, 1919.

⁷ American Journal of Roentgenology, January, 1919.

began to disappear and about nine weeks after the injury had entirely disappeared. This case of Potter is interesting because of the absence of any complication. Usually pneumocranium has been discovered chiefly through a complicating meningitis or abscess and as Potter says, many uncomplicated cases have been overlooked, because in but few cases are the x-ray exposures made two or three weeks after the injury. Because of the presence of fluid in the cavity, Potter speculates as to the possible role of pneumocranium in the etiology of traumatic cysts. There was reason to believe in the case above recorded that while the air was absorbed the fluid persisted. That the cavity did not give rise to serious symptoms may be attributed to its location in the frontal lobe.

Gunshot Wounds. A few reports concerning the treatment of head injuries have appeared during the past year, but there is little of importance to add to last year's review on this subject. At that time the most favorable methods of procedure had been selected, the best technic chosen and the others discarded, and the immediate and late results of large series had been recorded. The technic of Newton and Brown⁸ was very similar to that of Cushing, and their conclusions were practically the same as we emphasized last year, namely: 1. Operation should be performed at the earliest possible moment after the infliction of the wound. 2. Local anesthesia should be employed. 3. The wound should be completely excised, the fracture removed *en bloc*, and the brain wound cleaned gently and thoroughly by the catheter method. 4. In the infected wounds the B. I. P. P. pack method is of great service. 5. The prognosis depends largely upon the extent of the cerebral injury. 6. The real gravity of cerebral wounds can only be judged by statistics extending over long periods. The results will be influenced by two factors: (a) the extent of the cerebral lesion; and (b) the completeness of the operation. 7. A careful, gentle and thorough cleansing of the cerebral wound will reward the surgeon a thousandfold for the time spent in its accomplishment.

Horrax⁹ reports his results on a series of head wounds treated in a casualty clearing station of the B. E. F., under the direction of Colonel Cushing, and the general operative measures and technic employed and described by Cushing were adopted by him. Out of 222 cases of gunshot wounds of the head, the chief interest lies in 132 cases of compound fractures of the skull. Of the total, 101 were cases of dural penetration and 31 were cranial fractures without injury to the dura. Operation was performed on 93 of the 132. Of the remaining 39, 26 were, on arrival, well on the road to recovery, and the remaining 13 were practically moribund. They arrived from twenty-four hours to four days after injury, usually with large quantities of foul, infected brain tissue extruding from their wounds, from 50 per cent. of which a culture of gas bacillus was demonstrated.

Of the total 132 fracture cases, there were 48 deaths, a mortality of 36.3 per cent.; of the 101 penetrating wounds, there were 47 deaths, a mortality of 46.5 per cent. The operative mortality for the whole

⁸ British Journal of Surgery, 1919, vii, 73.

⁹ Ibid., 10.

series was 37.6 per cent.; and for the 76 cases with dural penetrations, 44.7 per cent.

The tremendous importance of early operation is emphasized by the prevalence of gas infections. If operation is not performed early, particularly with large, open wounds, the infection will have received such a start that it is seldom possible to prevent a fatal termination. Concerning the extensive removal of bone advocated by Cushing, Archibald¹⁰ is inclined to think "that Cushing's *en bloc* removal of the wound in the bone is unnecessary as a means of avoiding infection and has the disadvantage of leaving an unduly large defect in the skull. The patient later is very apt to complain of the pulsating brain in this large defect, and to ascribe his headache and dizziness to the mere fact of the bone being lacking. Good results are obtained by rongeur away the bone edges and leaving a defect as small as possible."

War Headache. A very interesting and original contribution from Rawling was referred to last year on the subject of cerebral edema as a cause of headache in patients suffering from chronic malaria or heat stroke. Rawling observed in these patients, who were attached to the troops in the Mesopotamian Campaign, that immediate relief was afforded by a subtemporal decompression. Upon his return to London and assuming charge of hospital wards, through which passed hundreds of patients with head injuries, he¹¹ again became interested in the problem of headache, "war headache," as he calls it, and its relief. From this mass of material he made some general observations:

1. "The more severe headaches are associated with an intact skull (closed box) or with small defects. With large deficiencies headaches are less frequent.

2. Frontal and temporal injuries are more commonly accompanied by headache than injuries in the parietal, occipital and cerebellar regions.

3. Wounds near the vertex, in relation to the superior longitudinal sinus, are frequently associated with a severe type of headache.

4. The presence of foreign bodies within the skull is commonly accompanied by chronic headache, more especially when the foreign body is situated in relation to the ventricles of the brain."

In the majority of cases the headache dated from the moment of recovery from unconsciousness and varied from mild and inconstant attacks, through every degree and grade of headache, to the most severe and persistent pains. Perhaps the most common type was a "cyclic" headache; two or three days of comparative immunity, followed, without warning, by an attack severe even at its inception. This culminated within a few hours with more or less complete prostration, the patient retiring to bed completely bowled over. This exacerbation terminated within twenty-four hours, leaving the patient still suffering from some degree of headache, perhaps a sense of oppression only. Further improvement then took place, bringing the patient back again to the period of comparative immunity.

In explanation of this "cycle" headache, Rawling thought it probable

¹⁰ Medical Record, 1919, xvi, 16.

¹¹ British Medical Journal, April 19, 1919.

that the cerebrospinal fluid, by reason of insufficient absorption, slowly increased in quantity, finally arriving at a certain maximum which coincided with the period of maximum intensity. By this time the fluid leads to such increase of intracranial pressure that some relief takes place automatically, the various channels being opened up whereby some excess fluid can escape. The intracranial pressure is correspondingly relieved and the symptoms subside proportionately.

In other instances the pains showed little variation in degree, persisting both day and night without intermission; the patient was never free from some degree of headache, varying from "dragging," "weight," "tearing" sensations to a constant dull ache. To these pains, after months and even years of suffering, some men became accustomed, despairing of cure, procuring temporary alleviation with aspirin, etc., and regarding the headache as a thing that must be endured.

Associated with the headache, in some, not all instances, were the following symptoms:

1. Slowing of the pulse-rate, with but little raising of blood-pressure.
2. Marked giddiness.
3. Elevation of temperature frequent, 99° to 100°, night after night, This may persist for months on end.
4. Insomnia.
5. Slow cerebration. Listlessness, anxiety, uncertain temper, depression. Patient unable to undergo any exertion, all attempts being followed at once by headache exacerbation.
5. Tendency to exaggeration of all reflexes.
7. Nausea uncommon. Vomiting rare.
8. Slight blurring of the disks—retinal veins engorged and tortuous. Diminution of the visual fields. True papilledema rare, unless the case is complicated by the presence of foreign bodies in the brain substance, especially when related to the ventricular spaces.
9. Bowels natural, except for some constipation. Urine normal.
10. Appetite good, except during an extra severe attack.
11. Fits, generalized, epileptiform.

I have given rather fully the description of these headaches in Rawling's own words, since this seemed essential to a clear understanding on the part of the reader of the condition under consideration. I was surprised, however, to learn how much of a problem headache was in those convalescent patients. In the 200 convalescent soldiers at one time under my care, all of them with cranial injuries, I did not find any in which operation seemed indicated alone for the relief of headache, nor was headache of the violent type Rawling describes observed, unless in the exceptional case of abscess or meningitis. To be sure many of my patients had headache but of so moderate a degree that at no time did it become a surgical problem. This dissimilarity in experience seemed to be worthy of note.

To continue with Rawling's observations; in the majority of instances he was very positive that the headache was due to a cerebral edema, in a few cases to ventricular distention. This he believes is the correct interpretation and his views were confirmed at operation. He usually

began treatment with rest in bed, proper diet, and appropriate medicinal remedies. This afforded some relief, but the pain usually recurred when the patient got up and resumed his activities. Lumbar puncture was unreliable; sometimes the relief was only transitory, sometimes there was none at all and sometimes the headache was aggravated. It was not until he decompressed that substantial relief was obtained usually within twenty-four hours. The late results were satisfactory; real relapses were rare, although during the convalescent stage there were often mild recurrences, usually of short duration, and the appearance of new pains, also of transitory duration. These "new" pains were described as thumping pains in the decompression opening and were attributed to trauma at the site of the operation, possibly to a sub-temporal hemorrhage. However, they disappeared in a few days and on the whole the patients expressed themselves in terms of gratitude for the relief obtained.

Pituitary Surgery. The whole question of pituitary surgery is still *sub judice*. Whether to be content with a sella decompression with such imperfect removal of the pituitary tumor as is possible by the transphenoidal approach, or to attempt a more radical removal by the transfrontal method must still remain open for discussion. Sufficient data at the present time is not available as to end-results and upon this together with the operative risk will the final decision rest. In either method the immediate results may be entirely successful, but there would seem to be little assurance of permanent results from the imperfect removal by the transsphenoidal route. Consequently I have kept an entirely open mind on the subject and have tried to study the respective merits of the two methods, more particularly with a view to determining whether there may not be in the individual case distinguishing features which would prompt one to select this method rather than the other. With accumulating data I hope it will soon be possible to state under what condition the transphenoidal method should be preferred to the transfrontal and *vice versa*.

Adson¹² reports a series of 6 cases in which he used a modification of the transfrontal method. The osteoplastic flap is made within the hairline and the dural flap at right angles. The frontal lobe is then elevated until the optic commissure and pituitary structures are exposed. In 3 cases not only the tumor but three-fourths of the normal gland was removed; in a fourth, the tumor was completely removed and "the sella curetted, leaving no possible trace of pituitary substance." This is the first instance in human or animal surgery where the removal of the entire gland was not fatal within a day or two; in fact it is the first case that any attempt in the human has been made to remove the entire gland and the apparent harmlessness of this heroic procedure impresses one as bordering on the miraculous.

In discussing the *choice of method* upon the pituitary body I¹³ took up the subject from three points of view: (1) safety and practicability, (2) amplitude of exposure and (3) end-results. In a series of cases collected

¹² Journal American Medical Association, No. 9, vol. vii.

¹³ Surgery, Gynecology and Obstetrics, July, 1919.

by Cope the mortality of the submucous septal method was 9 per cent., and the fronto-orbital method 8.6 per cent. Adding to this 8 unreported fronto-orbital operations without a death, the mortality of this method is reduced to 6.4 per cent. It is quite evident, therefore, that, from the standpoint of mortality rate, the two methods of approach compare favorably with one another. I believe, however, that in the course of time, as the surgeon becomes more familiar with the various steps of the operation, the cranial method will prove to be the safer, if only for one reason. By the endonasal route meningitis must always be reckoned with, and, as a matter of fact, has been responsible for the majority of fatal cases. One can never have the assurance, in the endonasal route, that the sphenoid sinuses are, even in healthy subjects, free from contaminating organisms. Two of the three deaths in my clinic following the endonasal operation were due to meningitis. In the fronto-orbital operation the approach to the sella may be made without invading a contaminated field, provided one avoid the frontal sinus; and in this cranial approach to the sella turcica the surgeon has no more concern about meningitis, as a complication, than he has in the exploration of any other cranial structure by the osteoplastic method.

Viewed from the standpoint of what I have called "practicability" in the light of the surgeon's training, the fronto-orbital method is the natural choice. The endonasal technic involves maneuvers entirely foreign to the surgeon's experience. From beginning to end the field of operation is cramped, one must depend altogether upon artificial illumination and at no time has one what might be called a satisfactory view.

As to the "amplitude of exposure" there is no doubt that when the pituitary lesion is primarily and exclusively intrasellar and at the time of operation has not extended beyond its bounds, the lesion may be dealt with satisfactorily by the nasal approach. In this category, for example, would be many cases of acromegaly, where the sella turcica is more or less uniformly increased in all its dimensions, depending somewhat upon the size and shape of the underlying sphenoidal sinus. But few, if any, operations are performed for acromegaly alone. The principal indication is the involvement of the optic tracts or chiasm, and this in many instances implies an extrasellar extension. In other words, a pituitary lesion entirely intrasellar is not sufficient to cause optic atrophy and certainly not the signs of increased intracranial tension. The presence of either of these bespeaks usually an extrasellar extension, and to my mind this should be recognized as a strong argument in favor of the frontal approach.

Another point in favor of the transfrontal approach is the fact that in so many instances it is quite impossible before the operation to determine the extent of the lesion. Even the roentgenogram will fail to distinguish between the purely intra- and extrasellar lesion. I can recall in my own series, for example, the case of a man aged sixty-one years who had symptoms of hyperfunction of the anterior lobe. The clinical picture was typical, the x-ray findings characteristic of an intrasellar lesion. Had I chosen in this case to approach the lesion by the

endonasal route I would have overlooked altogether an endothelioma, the size of a plum, taking its origin from structures in front of the pituitary. This tumor was unquestionably the primary lesion, the symptoms of pituitary disorder secondary. Is it possible to say before the operation whether the lesion extends beyond the limitations of the sella? According to Cope, "it seems certain that every case with visual symptoms must have considerable intracranial extension of the growth. I have searched the literature of pituitary operations fairly thoroughly and have not yet found a case with optic symptoms in which verification at operation or autopsy was permitted, which did not show a large intracranial extension. We conclude, therefore, that all pituitary tumors which come to operation for symptoms other than acromegaly have long before burst the bounds of the fossa." This is a very sweeping statement, but, making allowances for certain exceptions, it remains a strong argument for the cranial plan of operations, since by the nasal route only a portion of the growth is accessible.

The last, and third, test by which I have attempted to weigh the relative merits of the two procedures under discussion is the end-results. This in time should be the acid test of all operative procedures, but in this field of surgery sufficient time has not elapsed to apply it. Case reports have not included end-results, and the records of regurrences and the records of improvement after operation in months or years are not available in sufficient numbers to enable one to make accurate and reliable deductions. To be sure, recurrence of symptoms, no matter what the method, will be frequent and necessarily so because the contents of the sella cannot be emptied completely, for obvious reasons.

With regard to technic my original plan involved a reflection of an osteoplastic flap from the frontal region, the temporary resection of the supra-orbital ridge, the removal of what remained of the roof of the orbit. With the head in the Rose position, the orbital contents were displaced downward, the frontal lobe elevated until the optic nerve was exposed as it emerged from the optic foramen. The sella contents were brought into view by a horizontal incision in the dura a centimeter above the base of the skull. As originally described, the operation gave a somewhat restricted view of the sella contents, and since then I have modified the technic to overcome this objection. The essential difference between the two methods is that in the original, the approach to the sella was extradural, whereas as now practised, the approach is intradural. This modification introduces a T-shaped incision in the dura with its horizontal limb on a level with the supra-orbital ridge and the vertical limb extending downward toward the sella turcica. By this slight change in technic the frontal lobe is elevated with greater facility and the view of the sella region very much more satisfactory. Furthermore, the intradural route avoids the necessity of removing the roof of the orbit, a rather tedious step in the original technic. Certain modifications of the osteoplastic flap have been proposed by others to avoid the necessity of the mid-forehead incision, but the cosmetic results of my own series, following closure of the wound with epidermal suture, have been so good and the advantages of reflecting the flap toward the temporal region are such that I hesitate to change.

In the London *Lancet* of July 5, 1919, Whale describes an operation for the removal of a pituitary tumor, which reminds one somewhat of the original Schloffer method, so long discarded. What the advantages of this method are I do not know, for it involved a tracheotomy for the administration of the anesthetic, opening of the antrum, nasal cavity and ethmoid cells as well as the sphenoid sinus. I can describe the operation only by using the author's words. "A modified Moure's incision was made on the left side. The vertical limb of this took the ordinary course down along the junction of nose and cheek. The horizontal limb passed outward in the skin only as far as just beyond the punctum lacrymale. Thence, it was carried through the lower tarsal plate and along the deepest part of the conjunctival fornix for three quarters of an inch. The bone, now removed with saw, chisel and bone forceps, was bounded as follows: Mesially by the pyriform opening, and the internasal sutures; above by a horizontal line, cutting off a bare one-eighth inch of the nasal process of the frontal bone; laterally and below, by a line from the center of the infra-orbital margin to the middle of the pyriform opening (this line just spared the infra-orbital vessels and nerve); laterally and above, by a curved line, skirting the infra-orbital margin.

The naso-antral party wall was now freely cut away; the nasal duct was not seen or recognized. The ethmoidal gallery was nibbled away and the sphenoidal cell identified. Of this, the whole outer wall was cut away. At this stage, I had been prepared to sever the bony septum from its attachments above and to dislocate it to the right temporarily for better access to both sphenoidal cells; this maneuver, however, proved unnecessary. The whole cavity was carefully cleared of minute fractions of bone and mucosa and swabbed, and fresh adrenalin applied for five minutes. The sellar floor was now, to a large extent, removed piecemeal by the use of one of the curved gouges belonging to a West's intranasal dacryocystotomy set. The bone was seemingly very thin. No force at all was required.

What appeared to be a collapsed cyst, which, when intact, would have been about the size of a small cherry, presented. It was removed; a very small amount of clear fluid escaped; no pus was anywhere encountered. All loose tissue was removed from the cavity. A long malleable probe was now used to explore the depths. As far as could be discovered by the probe and by the vision, this cavity had now been emptied. It was bounded by intact dura above and on both sides; the dura pulsated slightly."

ORGANOTHERAPY IN PITUITARY DISORDERS. In the management of pituitary disorders one should have an intimate knowledge of what is known of the physiological action of the pituitary secretions and of the relation of this gland to other endocrine glands. To me the whole question of pituitary disorder is one of absorbing interest and the longer one's experience, the more is one impressed with the surprising frequency of patients who exhibit some evidence of disturbed function of mild degree. One rarely sees the exaggerated types as illustrated by the giant and the dwarf, but as we become more versed with the clinical

expression of hypo- or hypersecretion, it is surprising how often cases of mild degree are brought to one's attention. There are many cases in which glandular feeding should be employed before an operation is considered and many too where the operation should be followed by glandular feeding. In all the cases that are brought to the surgeon's attention, those which require operative relief are in the minority. Hence I regard it as essential that the surgeon should keep himself informed with the observations, both experimental and clinical, that are made upon the physiological action of the gland; he must keep abreast of the times in all matters relating to glandular feeding, to methods of administration, preparation and dosage, to be able to deal intelligently with the case under consideration. Therefore I include in this review of pituitary disorders matters relating to organotherapy as well as those of surgical technic.

The best results in glandular feeding according to Glassburg¹⁴ are obtained by beginning with a small dose and gradually increasing it, using the blood-pressure as a guide. He has obtained very favorable results in a case of typical dyspituitarism by commencing with four grains daily by mouth, the dose being gradually increased to six and then to eight grains. The patient, a woman, aged twenty-eight years, suffered from bitemporal headaches, muscular weakness, drowsiness, adiposity, general hypertrichosis, increased tolerance for sugar, low blood-pressure and pulse. At the end of five weeks, her headaches had disappeared, she had gained no weight and was able to be more active with less muscular fatigue; the blood-pressure had risen from 108-96 to 120-100, and the pulse-rate from 60 to 70. Glassburg notes that it is important to discontinue the extract during menstruation as it causes marked increase in the flow.

Of the diseases attributed by some to pituitary deficiency and said to be benefited by pituitary feeding, epilepsy should be mentioned. In a careful study of 200 cases of epilepsy, Tucker¹⁵ found in 63 evidences of pituitary disturbance, and regarded 28, or 14 per cent., as pure pituitary cases. Pituitary feeding, with the whole gland, occasionally with the anterior lobe (never the latter if the blood-pressure is high) brought about a marked improvement and in some cases a complete cure. He omits the bromides as soon as possible. The best results were obtained when the pituitary disturbance occurred during adolescence. Tucker divides his adolescent pituitary cases with convulsions into two groups: (1) Chronic or congenital types in which patients have increased fat, lack of body hair, feminine distribution of pubic hair in the male, scanty menstruation in the female, diminished perspiration, increased sugar tolerance, small genitalia, frequently bradycardia and lowered blood-pressure; (2) transitional types in which the patient, hitherto perfectly well, exhibits signs of pituitary disorder during adolescence. In the latter type the patient begins to take on flesh, has increased desire for sweets, becomes less energetic, eats voraciously, perspires less and has a slow pulse and low blood-pressure. Roentgenological studies in the

¹⁴ Medical Record, 1919, xcvi, 461.

¹⁵ Arch. Neurol. and Psychiat., 1919, ii, 192.

first group show small fossæ with large, clubbed, posterior processes and frequently elongated anterior processes, many showing irregularities in the contour of the posterior part of the sella. In the second group the fossæ are of normal size or slightly enlarged; the posterior processes are enlarged and clubbed, the anterior processes often enlarged, and usually roughening of the posterior contour of the sella. These transitory pituitary changes, causing convulsions or psychoses during adolescence, Tucker considers particularly amenable to glandular therapy. The view held by most neurologists today, and so well expressed by Tucker, is that epilepsy is not a disease, but a symptom; that it is an organic, not a functional, condition to be attributed to a number of causes, among which are "certain conditions of the pituitary gland causing a change in its secretion, uremia, eclampsia and other toxicoses, trauma, intracranial irritation, brain tumor and cerebral hemorrhage, and certain infections, as syphilis and meningitis; certain conditions of cerebral maldevelopment, accompanied by a degree of brain cell deterioration." If the secretion of the pituitary, as has been suggested, passes into the cerebrospinal fluid and bathes the cerebral cortex, is it possible that a diminution or absence of secretion may cause deterioration or definite organic changes in some of the cortical cells? It is entirely open to conjecture, as Tucker says, whether the deterioration is due to lack of the pituitary secretion or to toxic substances, which become active in its absence.

Some Italian observers¹⁶ have tried to establish a relationship between the pituitary and adenoids; this relationship is exhibited they believe in the "Citelli syndrome," so common with adenoids. They urge early removal of adenoids to prevent any possible damage to the pituitary, and if in cases with psychoses the removal of the adenoids is accompanied by pituitary feeding, there is often marked improvement.

Further experimental studies on the *effect of pituitary extract on the rate of growth and reproduction* have recently been made by Marinus.¹⁷ This investigator divided 100 young white rats into three groups; the first of these groups was fed upon the pars anterior, the second, upon the pars tuberalis, and the third upon beef muscle, as a control. At the end of twelve weeks, the first group showed an accelerated rate of growth and more rapid development of the reproductive system, as demonstrated by gross and microscopic hypertrophy of the sexual organs and by the earlier birth of their young; the second group showed none of these changes. The effects derived from the administration of the anterior lobe cannot therefore be attributed to a contamination with pars intermedia. In a series of studies on the effect of pituitary tissue (anterior lobe) upon the rate of growth in white mice, Robertson and Ray¹⁸ found that in both males and females, although most markedly in the latter, growth was first retarded and then at the end of the thirtieth week considerably accelerated.

¹⁶ Caliceti: *Pediatrics*, 1919, xxvii, 161.

¹⁷ *American Journal of Physiology*, 1919, xlix, 238.

¹⁸ *Journal of Biological Chemistry*, 1919, xxxvii, 427.

HISTAMINE AND THE PITUITARY. Abel and Kubota,¹⁹ in their efforts to isolate histamine, the substance held by Dale, Richards, and others, to be responsible for traumatic shock, have found that this substance is present in relatively high concentration in the posterior lobe of the pituitary gland. They found that the effects of a picrate prepared from the posterior lobe of the pituitary and the picrate of histamine on the non-gravid guinea-pig uterus were identical throughout. Hence, histamine is the plain muscle stimulating and depressor constituent of this lobe of the pituitary. However, histamine should not be looked upon as the hormone specific to this gland, since it occurs to a greater or less extent in all tissues. The authors found that this substance histamine, which stimulates plain muscle, depresses the circulation and causes prostration simulating shock in large doses, is present in practically all animal tissues, organ extracts and enzymatic products. The large quantities produced during the process of digestion play an important part in the stimulation of the gastric and intestinal musculature and in the dilatation of the capillaries during digestion. It is also one of the chief constituents of mutilated tissues. They have at present no explanation for its relatively high concentration in the posterior lobe of the pituitary.

THE RELATION OF THE PITUITARY TO OTHER ENDOCRINE GLANDS. To study the functional correlation between the hypophysis and the thyroid, Larson²⁰ carried on a series of investigations in which he made a careful study of the results of the direct administration of the anterior lobe to thyroidectomized rats. The anterior lobe had a beneficial action both upon their maintainance and growth and seemed to prolong life. This influence may be attributed to a direct substitution in which the pituitary takes the place of the thyroid hormone in a compensatory effort to establish normal metabolism. Or the result might be due to a stimulating effect upon the total metabolic processes. A definite decision can only be obtained by extensive study of the various factors involved.

The relationship between the pituitary and other endocrine organs is suggested by a recent case reported by Good and Ellis²¹ in which the patient, a man aged fifty-eight years, presented symptoms of pituitary and thyroid disorder. For five years he had suffered from subnormal activity of all bodily functions—a typical picture of myxedema—and his condition was not helped by thyroid extract. The x-ray showed the posterior clinoid processes of the sella had disappeared. The carbohydrate tolerance was found to be over 250 grams glucose and changes in the eye grounds were present. There were definite remissions and exacerbations. Pituitary extract was given from time to time, but usually had to be stopped because of pain over the heart, nausea or vertigo. Five years after the onset of the first symptoms, the patient succumbed to an attack of pneumonia. At the autopsy, there was found a hemangio-endothelioma of the pituitary body, atrophy and sclerosis

¹⁹ *Journal of Pharmacy and Experimental Therapy*, 1919, xiii, 243.

²⁰ *American Journal of Physiology*, 1919, xlix, 55.

²¹ *Endocrinology*, 1918, ii, 431.

of the thyroid, testes, adrenals and skin, and persistence of the thymus gland.

RELATION BETWEEN THE PITUITARY AND DIABETES INSIPIDUS AND CARBOHYDRATE METABOLISM. The relation between diabetes insipidus and lesions of the pituitary, and the part played by this gland in regulating the secretion of urine has been a much mooted question since the first physiological studies. While Kennaway and Mottram²² have been unable to find in literature any cases of diabetes insipidus in which a lesion of the pituitary had been excluded by postmortem examination, nevertheless diabetes insipidus is not a constant accompaniment of pituitary disorder. In a careful study of the effects of pituitary extract in diabetes insipidus, the authors found that subcutaneous injections of pituitary extract had a decidedly antidiurectic action, the volume of urine being reduced by a single injection to about one-half; and a similar effect was observed in cases in which the urine was normal; but when the extract was given by mouth there was no diurectic effect in either the normal or the diabetic cases. The immediate return to normal conditions, which Kennaway and Mottram observed in 2 cases of diabetes insipidus after the subcutaneous injection of pituitary extract, suggests a regulatory function of the pituitary on urinary secretion, and in the light of many experiments which I have previously reviewed, one might assume the pituitary acts directly upon the kidney. Unfortunately, as a practical problem in the treatment of diabetes insipidus, the effect is only transitory, and the injection must be repeated every twelve hours. Diabetes insipidus occurs not only in cases in which the clinical signs point to hypopituitarism, but also in cases in which other endocrine glands are involved, as in the case recently recorded by Beck and McLean²³ in which symptoms involved the pituitary, thyroid and gonads. In this case, the subcutaneous injection of pituitrin alone had any effect upon the polyuria. After a subcutaneous injection of 1 c.c. pituitrin, the excretion of urine in twenty-four hours fell from 13,000 c.c. to 2000 c.c.

While it has been admitted that the pituitary plays an important role in carbohydrate metabolism, the physiological action of the pituitary in this role has not been perfectly understood. In a previous series of investigations, Keeton and Becht observed "that stimulation of the hypophysis produced a hyperglycemia, which did not occur if the stimulus was applied contiguous to but not on the gland, and that this rise in sugar was absent in animals whose splanchnic nerves had previously been sectioned." These authors²⁴ have recently made further studies in an attempt to determine the significance of the nervous relationship between the hypophysis and the glycogenic process, and have come to the following conclusions: 1. Stimulation of the hypophysis in dogs causes hyperglycemia independent of the ether used in the anesthesia. 2. This hyperglycemia is absent after transection of the cord at the level of the second thoracic vertebra and after section of

²² Quarterly Journal of Medicine, April, 1919, p. 225.

²³ Therapeutic Gazette, 1919, xliii, 158.

²⁴ American Journal of Physiology, 1919, xlix, 248.

the splanchnics. It persists after section of the nerves in the hepatic peduncles. 3. Following hypophysectomy a transitory hyperglycemia occurs and persists three to five hours. After this the sugar level remains normal until death. 4. If a hormone is liberated by stimulation of the gland, it must have a central action. 5. The view is favored that the pathway is a nervous one mediated through the splanchnic nerves to their terminations in the adrenals and liver. 6. The physiological role played by the hypophysis in carbohydrate metabolism does not deal with the transformation of glycogen into sugar, but more probably with the utilization of the sugar by the organism. The last conclusion is based upon the transitory nature of the hyperglycemia following hypophysectomy together with the maintenance of a fairly normal sugar level until death, both of which facts would lead us to believe that the hypophysis is not so much concerned with glycogenolysis as with some other phase of carbohydrate metabolism, such as the utility of sugar by the body.

Trigeminal Neuralgia. With the following introduction, Plett²⁵ bases his claim for the superiority of cervical sympathectomy over other radical operations for the permanent relief of trigeminal neuralgia. "The radical operation for the removal of the Gasserian ganglion is too difficult of execution for the average surgeon, and not a few cases are on record where the pain persisted in spite of complete removal. (J. B. Murphy, Doyen, Krause and others.) The same criterion may be applied to the method advocated by Frazier of the intracranial severing of the sensory root."

Whatever other advantages there may be in his revival of this treatment, as a substitute for operation upon the ganglion or its root, it is only proper to say that his premises are not true. After section of the sensory root the pain does not persist nor is the relief immediately afforded followed by recurrence. Whether there is any virtue in cervical sympathectomy, it should have stood the test of time and, as matter of record, we know this is not the case; this method was proposed many years ago and has never received the endorsement of the profession. However, Plett seems to have been unusually successful in that he has had "uniformly good results" in a series of more than fifty cases where the operation it is noted was combined with deep and superficial alcoholic injections. What part the latter played in the end-results must be left to conjecture and there are no statements as to the permanency of the relief afforded. There is this decided disadvantage in sympathectomy in that relief is not afforded for from two to three months. Plett attributes the relief of pain to vasodilatation, on the assumption that the pathogenesis of neuralgia is an anemia of the structures involved. There were two statements in his brief contribution that interested me, one that trigeminal neuralgia was common in Mexico, and two, that a patient with "tic douloureux of the hand," later developing a trigeminal neuralgia, was relieved of both by a cervical sympathectomy.

²⁵ American Journal of Surgery, No. 5, vol. xxxiii.

Barnhill's* article on the treatment of trigeminal neuralgia struck me as peculiarly out of date, since it dwells chiefly upon the extracranial operations which I thought had been discontinued save in exceptional circumstances. There are some statements he makes which are not in accord with my own experience. For example, he says, the branches of the trifacial nerve so overlap and anastomose with each other that it is difficult to determine which branch is primarily affected. Consequently he has had to operate upon patients who had not been relieved by other surgeons, because of mistakes in the selection of the nerve to be extracted. Later, he says, it is presumed that all possible causative factors (including diseased teeth, infected sinuses) "of the neuritis or tic douloureux" have been removed. I have never seen a case of tic douloureux, *i. e.*, the major form of trigeminal neuralgia, which could be traced to a peripheral lesion. In his technic for exposure of the branches of the ophthalmic division, he extends his incision well down the bridge of the nose and to reach the nasal nerve he cuts through the periosteum from the root of the nose to the lower end of the nasal bone and cautiously detaches the periosteum toward the apex of the orbit until the anterior ethmoidal foramen is reached. The nasal nerve can be seen entering the foramen.

For the maxillary division he prefers the transorbital route to the standard operation of Braun and Kocher. These latter were devised, he says, by general surgeons, *who presumably were not skilled in the use of the reflected light and therefore possibly not as dexterous in deep cavity work as the rhinologist.* The transorbital route includes the exposure of the infraorbital foramen, the separation of the periosteum from the orbital floor and the removal of the roof of the infra-orbital canal with a V-shaped chisel, so that the nerve can be lifted out back to the sphenomaxillary fissure. With the nerve held taut as a guide, it may be followed through the fissure, grasped deeply with an artery forceps and twisted away to the foramen rotundum.

Of neuralgia of the inframaxillary division, he has seen fewer cases. When the inferior dental branch alone is involved he prefers to approach *per oram*. Avulsion of a sufficient length of the nerve from the canal is not possible unless the canal is opened by chiselling and the nerve loosened throughout its entire length between the infradental and mental foramina. If the canal is not opened throughout, the nerve inevitably snaps at its entrance to the foramen. Hence in all operations on nerves, which traverse osseous canals, it is essential to open the canal throughout its entire length before any effort at avulsion is made.

I wish the author had told us more about his results, what was the percentage of permanent relief. One rather gets the impression from reading the article, although there are no case reports or statistics, that these peripheral operations, performed as he has directed, are as enduring in their results as the intracranial methods. If this be the case, the facts should be widely published, as under these circumstances peripheral operations would be given preference. It was only because recurrence

* Laryngoscopic, June, 1919.

after the peripheral operation was the rule rather than the exception that the intracranial methods came into vogue.

A long but very elementary discussion of the subject entitled "Rebellious Facial Neuralgia" has recently appeared from the pen of Labouré,²⁷ who concludes that gasserectomy is altogether too radical and should give way to alcoholic injections. He tells us rather naïvely how to practise alcoholic injections and how the injections may be given by dentists, oculists and even laryngologists. His conclusions seem to be based upon five cases but we are not told how many injections were given and what were the end-results.

I was rather amused with Bourguet's²⁸ attitude toward the generally accepted radical operation, section of the sensory root. He thinks this operation should be discarded because it is too difficult and because one case of cerebellopontile tumor, pressing upon the sensory root, had developed a neuromyotrophic keratitis. Hence he strongly recommends gasserectomy by the temporal route, but, I note, the author confesses all his patients developed a keratitis, which, however, responded to prolonged treatment.

Facial Diplegia. Facial diplegia, that is the synchronous involvement of both sides of the face by palsy, has been observed most frequently as due to multiple neuritis, occasionally complicating influenza, otitis media, syphilis and so-called Bell's palsy. As a complication of injury, diplegia is rare, Ransohoff²⁹ was able to collect only six cases including his own. The infrequency of it seems to be its principal claim to distinction. The majority presented evidence of basal fracture, with one exception the lesion was in the Fallopian canal, the eighth nerve was involved in certain of the cases, but, in all, function was resumed spontaneously within a comparatively short time. Hence it is assumed the paralysis was the result of hemorrhage or contusion and not rupture.

Hydrocephalus. Up to the present time the subject of hydrocephalus has not gotten beyond the experimental stage. By this I do not infer that the experiments have been made only in the research laboratory. Surgical literature is replete with attempts to cure hydrocephalus by methods too numerous to relate, but thus far we are forced to admit, that despite the many valuable contributions to the study of the causes of hydrocephalus, no substantial contribution has been made to the treatment. Many facts elaborated in the research laboratory seemingly of practical import, when applied clinically, have thus far been disappointing. As an illustration, I might cite the retarding effect of thyroid extract upon the activity of the choroid plexus. This phenomenon was demonstrated repeatedly in my laboratory several years ago, and though we know many cases of hydrocephalus are due to increased activity of the choroid plexus, the clinicians have not as yet reported any positive results from thyroid feeding.

Dandy,³⁰ in an article which bristles with optimism, directs our

²⁷ Bulletin Med., 1919, xxxiii, 379.

²⁸ Bull. de l'Académie de Médecin, Paris, lxxxi, No. 19.

²⁹ Annals of Surgery, August, 1919.

³⁰ Ibid., December, 1918.

attention to the treatment of hydrocephalus by extirpation of the choroid plexus and prefaces his remarks with the welcome news that hydrocephalus is a curable disease. The statement appears to be based upon theoretical considerations, since, later in the article we find that the clinical evidence at hand is four operations, with three deaths and one survival, the ultimate state of which is still undetermined. I do not want to speak disparagingly of Dandy's investigations or to discourage him in their continuance, but I think it is only proper to call the reader's attention to the apparent disagreement between the claims which are based on theoretical consideration and the operative results. The classification, which Dandy uses, corresponds closely to that which I evolved from the clinical and experimental evidence at hand, namely: (1) that due to diminished absorption, and (2) that due to increased production; to these two groups, I have added a third of unknown origin, not included in the other two, to which I have given the name *hydrocephalus occulta*. This classification, if adopted in the terms I proposed: (1) hydrocephalus obstructiva, (2) hydrocephalus hypersecretiva, and (3) hydrocephalus occulta, would simplify the nomenclature enormously and would imply a discriminating examination before the diagnosis was made.

In his consideration of the indications for resection of the plexus, Dandy limits his discussion to that particular type of hydrocephalus in which the obstruction and interference with absorption is due to adhesions in the subarachnoid space of the posterior fossa. The meninges are opaque and thickened, the pia arachnoid is firm, fibrous and adherent, particularly at the base of the brain. The presence of these adhesions, encircling the midbrain when it passes through the incisura tentorii, will destroy all communication between the posterior and middle fossæ and thereby eliminate the entire subarachnoid space over both cerebral hemispheres from participation in the absorption of cerebrospinal fluid. One or two of the three foramina may be obliterated. In substantiation of this explanation of what is called communicating hydrocephalus, it is stated that on the operating table the sulci appeared obliterated and devoid of fluid.

Taking up the question of treatment, Dandy makes the sweeping inference that all attempts at drainage of the ventricles have been unsuccessful. This statement is not borne out by facts nor do I know of any proof that fluid drained directly from the ventricles to the cortex may not indirectly enter the subarachnoid space. While the logical treatment of any disease is the removal of the cause, unfortunately in communicating hydrocephalus this is surgically impossible, hence it is necessary to do one of two things, either to establish some principle of drainage or to check the fluid at its source. The latter Dandy proposes in his choroid plexus resection with the results already alluded to. Inasmuch as the choroid plexus can be removed only from the lateral and not from the third and fourth ventricles, the total amount of cerebrospinal fluid can be reduced only four-fifths. (If the cerebrospinal fluid has any of the important functions ascribed it is perhaps fortunate that the surgeon cannot deprive the patient of the total output.) I have

been unable to find any positive data to verify this statement; "it is of course obvious that if more than the necessary amount of choroid plexus is removed, extra- and intravascular pressure differences will produce sufficient fluid to maintain the necessary amount of fluid to fill the ventricles." While in this article the author does not refer to any contributions to the study of hydrocephalus except his own, I have been wondering in this connection whether he has seen the work of Peet²¹ who studied the rate of flow, hence of production, of cerebrospinal fluid when the circulation of the common carotid artery and the internal jugular veins were interrupted. This would seem on the surface at least, to have some practical bearing upon this statement.

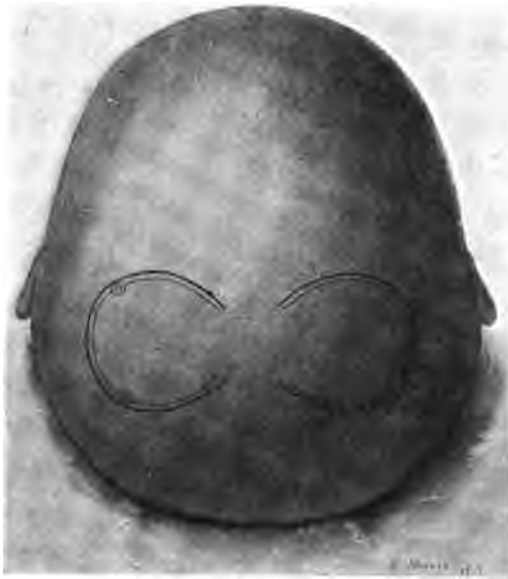


FIG. 1.—Shows location, shape and size of incision in scalp and bone for bilateral extirpation of choroid plexus of lateral ventricles. The solid line marks the skin incision, the dotted line the bone flap which is broken and reflected at the base. (Dandy, *Annals of Surgery*.)

The technic of removal of the plexus is described as follows: A small circular bone flap is made over the parietal eminence (Fig. 1). The wound is made well posterior to the Rolandic area and in a salient part of the occipital lobe. After ligating numerous vessels on the cortex by circumvection, the cortex is bloodlessly incised and this incision carried into the ventricle. From the exposure which is over the junction of the body and descending horn of the lateral ventricle, the entire extent of the ventricle can be brought into view (Fig. 2). The opening in the brain is maintained by an open nasal dilator (Fig. 3), or when the ventricle is very large the brain wall must be elevated by a spatula

²¹ *American Journal of Physiology*, 1914, No. 3, vol. xxxv.

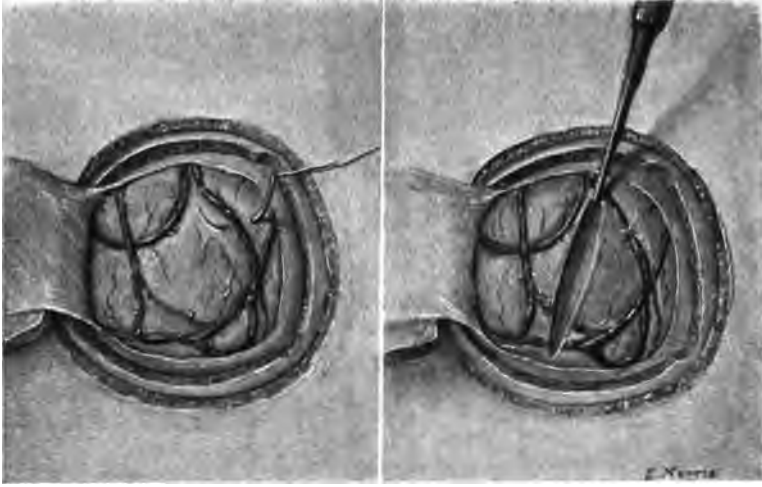


FIG. 2.—Skin, bone and dura are reflected; the cerebral vessels are doubly ligated with fine silk by circumvection. Between these two rows of sutures the cortex is incised with the scalpel and this incision carried through the ventricle. (Dandy, *Annals of Surgery*.)



FIG. 3.—The opening in the cortex is maintained by a nasal dilator. Through this opening the choroid plexus is removed in the manner shown in Fig. 4. The fluid has been entirely removed from the ventricle to permit exposure of the choroid plexus. (Dandy, *Annals of Surgery*.)

which is inserted into the ventricle. It is necessary to remove all the cerebrospinal fluid in the ventricle to get a view of the choroid plexus; the brownish-red flocculent choroid plexus can then be easily followed from the foramen of Monro to the tip of the descending horn.

The choroid plexus is picked up in forceps at the foramen of Monro (Fig. 3), and the vessels ligated by a silver clip. A pledget of moist cotton is inserted into the foramen of Monro to prevent blood gravitating into the third ventricle. The plexus is then transected and gently stripped backward from its narrow attachment to the floor of the body of the ventricle. When the glomus is reached the stripping from the



FIG. 4.—Coronal section through hydrocephalic brain, showing method of stripping choroid plexus from its attachment to the floor of the ventricle. The right plexus has been stripped from the foramen of Monro to the end of the glomus and at the tip of the descending horn is shown grasped by the forceps in the process of being stripped to the glomus. The entire plexus is then lifted from its bed. (Dandy, *Annals of Surgery*.)

body of the ventricle is stopped and the choroid plexus picked up at the tip of the descending horn (Fig. 4). This part of the choroid plexus is also stripped backward to the glomus; the remaining attachment of the glomus is then liberated and the entire choroid plexus removed in toto. Bleeding from the denuded area of velum interpositum is slight and easily controlled by moist saline cotton pledgets. Special care must be taken to leave no bleeding points.

The collapse of the brain following evacuation of the ventricular fluid causes a remarkable infolding of the cerebral walls, the extent depending of course upon the size of the ventricle and thickness of the cortex. In

advanced cases a tremendous cavity results, which is filled before closure with salt solution to restore the collapsed cerebral wall as nearly as possible to its natural convexity.

The opening in the cortex is closed with a series of interrupted fine silk sutures which are held by the delicate pia arachnoid membrane. The dura and scalp are carefully closed also with silk, special care being taken to prevent any subsequent leak of cerebrospinal fluid.

In his studies of the etiology of hydrocephalus, Dandy²² summarizes his results as follows:

1. Hydrocephalus has been produced by placing an obstruction in the aqueduct of Sylvius. Dilatation of the third and both lateral ventricles results.

2. One foramen of Monro has been occluded; this is followed by a unilateral hydrocephalus.

3. If the choroid plexus of one lateral ventricle is completely removed at the time the foramen of Monro is occluded, not only does no dilatation occur, but the entire lateral ventricle collapses.

4. This is the only absolute proof that the cerebrospinal fluid is formed from the choroid plexus. At the same time it proves that the ependyma does not secrete cerebrospinal fluid.

5. If the choroid plexus of both lateral ventricles is removed, and an obstruction is placed in the aqueduct of Sylvius, hydrocephalus still results in the third and both lateral ventricles, but at a reduced rate. The fluid forms from the choroid plexus of the third ventricle but cannot escape into the subarachnoid space.

6. Cerebrospinal fluid forms in all the cerebral ventricles. It is absorbed almost entirely in the subarachnoid space. The sole communication between the ventricular system and the subarachnoid space is through the foramina of Luschka and the median foramen of Magendie.

7. The phenolsuphonephthalein test will prove conclusively whether the foramina of Luschka and Magendie are open or closed. Closure of these foramina invariably causes hydrocephalus.

8. Hydrocephalus follows ligation of the vena magna Galeni if the ligature is placed at the origin of this vein. Ligatures beyond or in the sinus rectus have no effect because there is sufficient venous collateral circulation.

9. The communicating type of hydrocephalus has been produced in dogs by a perimesencephalic band of gauze, saturated in an irritant which induces adhesions. This obstruction prevents cerebrospinal fluid from reaching the cerebral subarachnoid space where most of the cerebrospinal fluid is absorbed. The resultant diminished absorption of fluid results from hydrocephalus.

10. Hydrocephalus follows ligation of the great vein of Galen because of an overproduction of cerebrospinal fluid. In other types of hydrocephalus, both obstructive and communicating, the accumulation of fluid is due to a diminished absorption of cerebrospinal fluid.

Disappointing as have been the results of the operative treatment of

²² *Annals of Surgery*, August, 1919.

hydrocephalus, we should not discontinue our investigative study of the disease nor should we disregard the results of experimental pathology in the animal. But we must acknowledge that the gulf between the laboratory and the clinic has not been bridged and traffic made safe for the surgical public. Every once in a while some one in a flight of fancy ventures across the gulf, but as a rule their survival in the new land is of short duration.



FIG. 5.—Decompression combined with osteoplastic flap.

Operative Technic. TOURNIQUET. Because of the necessity or desirability of combining a subtemporal decompression with an exploratory craniotomy, Sachs²² described the use of the tourniquet (Fig. 5) and substituted the clamp as illustrated in Fig. 6. It is applied as follows:

²² *Annals of Surgery*, July, 1919.

The incision is outlined on the skin in the usual way and the field then draped. Two small incisions, each not more than one-half inch in

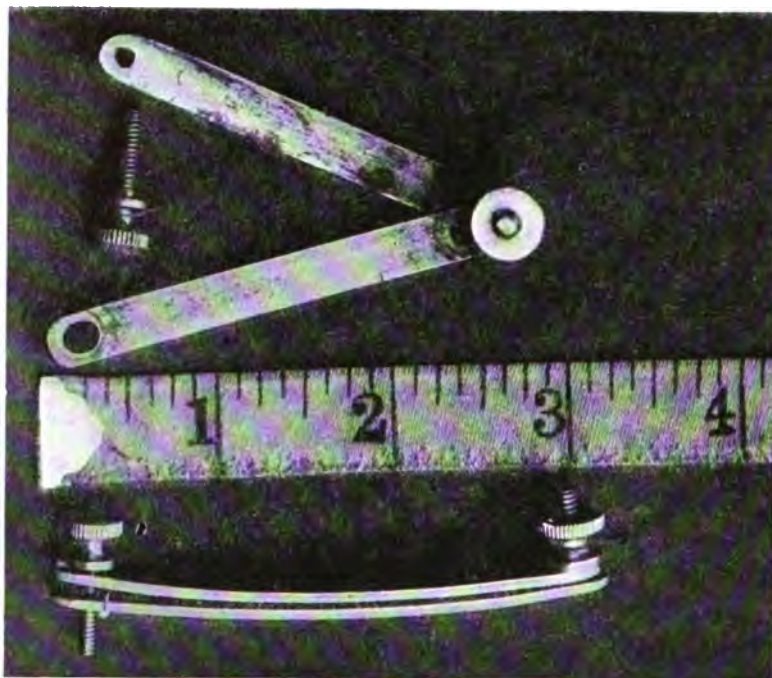


FIG. 6.—Shows clamp opened and closed.



FIG. 7.—Staphylorrhaphy dissector.

length, are made at the two ends of the incision. These are carried down to the bone. A staphylorrhaphy dissector (Fig. 7) is passed from one incision to the other, stripping the periosteum from the bone. One jaw

of the clamp is slipped through this space, the other jaw is slipped into place, and the screws tightened sufficiently to control all hemorrhage (Fig. 8). They should not be made too tight lest they strangle the tissues. The clamps are made of varying lengths and shapes to fit different heads.



FIG. 8.—Shows the clamp in place.

CRANIOCEREBRAL ROENTGENOGRAM METER. To aid in the location of fractures and foreign bodies, Manning²⁴ has devised the meter as illustrated in Figs. 9 and 10. The device is somewhat in the form of a chain cap with spiral springs attached at each junction of the chain, in order that it may adapt itself to various-sized craniums or heads. Small heavy linked steel chains are utilized for guide approximation on account of their density to the x-ray. Coiled springs are placed at various junctions of chains for adaptation to various-sized heads and shapes. Pliable metallic loops fit over the junction of the ears with the head, in order to fix the meter firmly and easily into position. Stencilled letter markers are soldered to this chain by required extensions. The glabella and external occipital protuberance are painted red and blue respectively for rapid adjustment on the head.

Cranioplasty. In previous issues of *PROGRESSIVE MEDICINE*, I have referred to the technic of cranioplasty and took occasion only last year to call attention to the profusion of literature upon this subject that had been stimulated by the war. Many surgeons had for the first time an

²⁴ New York Medical Journal, April 19, 1919.

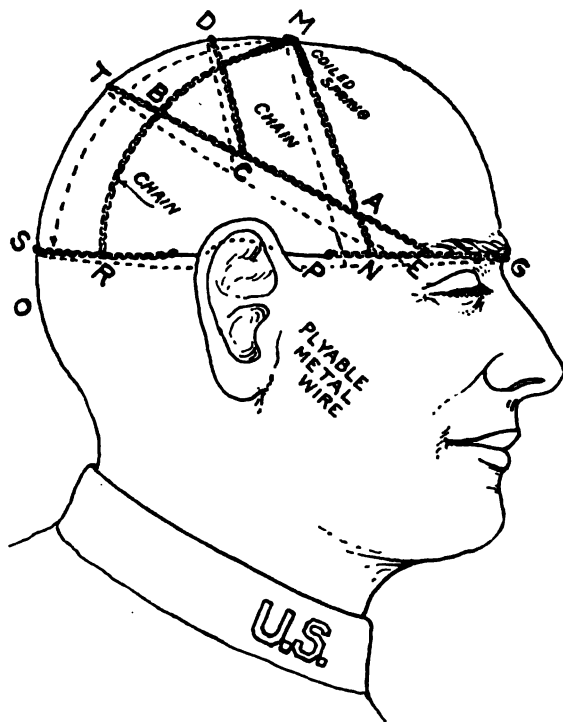


FIG. 9.—*G*, glabella; *M*, midpoint between *G* and *O*; *D*, upper end of a line parallel to *AM*; *T*, three-quarter point between *G* and *O*; *S*, seven-eighths point between *G* and *O*; *O*, external occipital protuberance; *E*, external angular process; *P*, root of zygoma; *N*, midpoint between *E* and *P*; *R*, midpoint between *P* and *O*; *A*, intersection of *MN* and *ET*; *C*, midpoint between *A* and *B*; *B*, intersection of *MR* and *ET*.

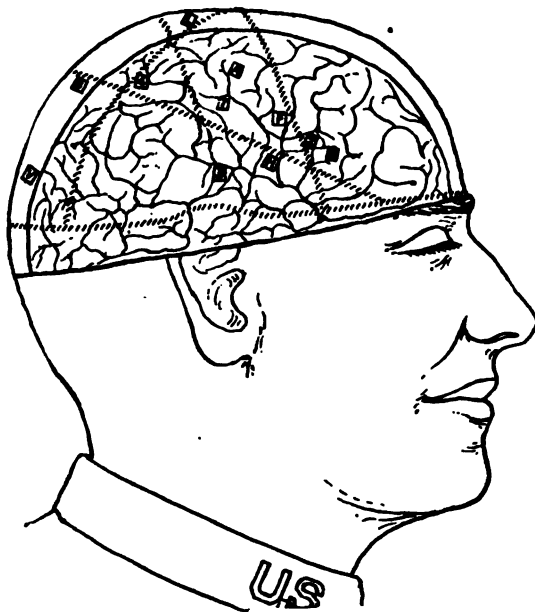


FIG. 10.—*L*, center for opposite lower limb; *A*, center for opposite upper limb; *F*, center for opposite side of face; *S*, supramarginal convolution; *V*, sensory visual center; *B*, Broca's convolution; *H*, first temporal convolution; *I*, fissure of Rolando; *3*, division of Sylvian fissure; *2*, parallel (first temporal) fissure; *4*, angular gyrus.

opportunity to perform this operation for the repair of cranial defects, originating from gunshot wounds, and treated the subject as though it was war bred. However, cranioplasty had frequently been performed in civilian practise and from an extensive experience both before and during the war, I concluded that the experience of military practise in this particular field had taught us no new lessons. The technic of cranioplasty practised for many years in my clinic, is, I believe, still the most satisfactory. Essentially it consists in the using as a transplant the outer table of the skull, procured from the patient. In other words, a living autotransplant. There had always been in my mind a theoretical objection in that bony outgrowths, exostoses if you choose, might form on the under surface and act as irritants to the dura. It was a source of gratification, therefore, to learn from the experiments of Wegeforth,³⁵ who performed the operation in the experimental laboratory by the same technic, that three months after the operation he found the graft fairly fixed at all points where it came in direct contact with the edge of the defect, the *inner surface overlying the dura smooth and free from all irregularities*. With this confirmatory evidence, never procurable in the human, I am more than ever convinced that the use of the outer table of the skull, as the transplant, is the ideal method. Wegeforth extended his experiments to the use of buttons of bone from dead animals and concluded that living grafts were preferable because the living tissue becomes vascularized and replaced more quickly; that when living grafts could not be obtained dead grafts could be used and were to be preferred to grafts obtained from other than the cranial bones. I am reminded that during the war dead grafts were used, as in the series of 85 cases reported by Sicard,³⁶ who found the grafts after thorough sterilization, well tolerated by the tissues.

In the second volume of "Travaux Scientifiques" from the Ambulance de l'Océan at La Parme, Belgium, Dr. Charles Janssen discusses the repair of loss of substance in cranio-encephalic injuries and their treatment by cranioplasty. The indications for cranioplasty, he concludes are as follows:

1. The restoration of external symmetry. This includes loss of substance situated in the frontal or fronto-temporal region; every poorly healed cicatrice; loss of substance accompanied with marked depression.
2. Prophylactic indications. To this class belong the following; (a) All cranio-encephalic lesions involving a loss of meningeal substance; (b) every cranio-encephalic wound which has healed by granulation; (c) every loss of substance of a dimension 3 cm. in diameter; (d) every loss of substance covered with thin and fragile connective tissue.
3. Curative Indications; under this heading come: (a) Such accidents as headache, vertigo, etc., if they are troublesome by their intensity or by their frequency, when the infectious cause of these accidents can be certainly ascertained. (b) Accessory accidents, grave or frequent, which are not caused by the existence of an intracerebral body or by a hematoma.

³⁵ Annals of Surgery, 1919.

³⁶ Bull. d'Academie de Méd. Paris, 1918, p. 33.

The contra-indications may be included in the following:

1. The vicinity of the ventricles feared by some; but is not to be accepted as an absolute contra-indication.
2. Permanent hypertension which does not give way to repeated lumbar puncture.
3. Every embedded projectile which cannot be extracted, especially if it is not well borne.
4. Every syndrome which suggests the existence of a latent meningeal or encephalic infection.
5. The presence of splinters which cannot be extracted at the time of operation.

As to the time of operation, he is not disposed to postpone the operation for three to six months—an arbitrary period—but to proceed with it as soon as the probability of latent infection may be eliminated. Given a patient who has always been free from pain, in whom healing by first intention has taken place, who presents no symptoms suggesting infection, one can practice the restorative operation as soon as the state of the soft tissues permits of it, possibly a month after the wound. He qualifies this general rule, however, by limiting early operations to simple cranio-encephalic wounds, in which the dura mater has not been opened. With this restriction and the implication, that the original wound had healed by first intention, no one, I believe, would object to the recommendation for early operation and the disregard of the three to six months rule.

His technic does not differ materially from that which I have endorsed, namely the repair of dural defects with grafts of fascia lata and of bony defects with bone rather than cartilaginous transplants. I cannot subscribe to his practice of wide excision of all meningeal and cortical substance that appears to be the seat of cicatricial invasion. This adds materially to the risk of operation and with the naked eye it would be difficult to determine exactly how far the cicatrization may extend into the cortex. Furthermore, the reparative process of such an excision would eventuate in a cicatrix quite as damaging as the original lesion. For these several reasons, I have never advised in operations for the repair of cranial defects, any attempt at restoration of the cortex. Should there be a dural defect this should of course be repaired with a fascial graft and every effort made to prevent the formation of adhesions between the bone transplant and dura or fascial graft.

Perhaps the most interesting phase of the subject of cranioplasty is the effect of the closure of the cranial defect upon such symptoms as the patient may have complained of beforehand. Apart from the evidence of an organic lesion usually due to a destructive lesion, such as aphasia and hemiplegia, patients with cranial defects are subjects of headache, dizziness, depression, anxiety, sometimes a dread of injury and sense of insecurity. Among the patients that passed through my wards in the government hospitals, I should say the majority had headache to a mild degree and most of them noted dizziness upon change of position, particularly in changing from the sitting to the standing position. I saw but few who were depressed and not many who had any sense of inse-

curity. In fact, it was only the minority who seemed inconvenienced or incapacitated enough by any of the above symptoms, to come for relief of their own volition to the surgeon. Furthermore, I do not recall any really striking results from the operation, by that meaning the total disappearance of all subjective symptoms and the transformation from a state of depression to that of exhilaration. This is the impression I find many surgeons would give one of the results, whereas by a more prolonged and intensive study this picture would be found to be exaggerated.

In his report of a series of 34 cranioplasties, Primrose²⁷ records 19 as completely relieved, 8 as improved, 5 unimproved and 2 as worse. Of the value of the operation, he goes so far as to say that when the headache is not relieved, the trouble is dependent upon some condition additional to that of the cranial defect. He speaks more conservatively about Jacksonian epilepsy and acknowledges the improvement noted after operation may be only transitory. He attributes the relief from epileptic series to the removal of scar tissue and the substitution of a fascial graft. As to the technic, Primrose used both cartilage and bone grafts and seemed to think one was as good as the other. He says with cartilage a good firm result may be obtained provided each piece of cartilage completely spans the gap and rests securely at either end upon the ledge of the inner table. (My experience with cartilage grafts was not at all satisfactory and I soon substituted the bone graft.) The bone graft in all instances he cut from the tibia, rather than from the skull, and here I think he made a mistake, since grafts taken from the long bones are apt to be more active at the points of contact, throwing out callus much in the same way as in the repair of fracture. These callous outgrowths finally organize into masses or nodes of condensed bone at the points of contact. There were no fatalities in his series but five failures, three due to infection and two to failure to make the cartilage completely span the gap. As to the fate of the grafts, he had seen no evidence of any tendency to absorption.

This has been the experience of surgeons generally. With perfect wound asepsis the grafts always "heal in" without exception, but complicated by infection, the grafts must be removed intact or will soon disintegrate. I recall one exception to this general rule in a patient who developed post-operative pneumonia and empyema. The wound healed per primam but by the time the patient was recovering from a thoracotomy, the graft, a bone graft, had become absorbed. This was the only instance of this kind that I had seen in cases uncomplicated by wound infections.

Control of Hemorrhage from the Lateral Sinus. To be able to enlarge the dural incision in front of the sinus in exploration of the anterior surface of the cerebellar fossa, the most frequent site of cerebellar abscess, Eagleton²⁸ introduces an original device (Figs. 11 and 12) applicable also to the control of hemorrhage from any of the large sinuses of the brain. In both the transverse and descending portions of the transverse

²⁷ *Annals of Surgery*, July, 1919.

²⁸ *Medical Record*, February 15, 1919.

sinus, it is possible to invulse the outer wall into the cavity, thus obliterating it. This the device is designed to do; it holds the two ends of the suture apart so as not to compress the fixed dural attachments, while the descent of a metal obturator causes an invulsion of the outer wall of the sinus into its cavity, obliterating its lumen. The technic of the application of the suture as described by the author is as follows:

A small opening is made in the dura, on each side of the sinus, using a triangular dural knife or cystotome. A ligature is passed from one dural opening to the other, using a full curved needle with the point blunted, damage to the cerebral tissue being avoided by hugging the



FIG. 11



FIG. 12

dural surface. One side of the ligature is knotted in its center and the suture placed in the slot of the carrier and of the obturator of the same side. The other side of the ligature is then placed in the opposite slots, and, using the knotted point of the ligature as a fulcrum, is tightened sufficiently to cause slight indentation of the sinus; when the ends of the ligature are tied in a bow knot over the cross-arm of the carrier. Tightening the upper screw of the carrier will cause the descent of the obturator into the sinus, obliterating its cavity. Using an artery clamp, the slots in the soft metal arms of the obturator are then pressed firmly against the suture, holding it in position; the suture above is then loos-

ened, and removed from the slots of the carrier, and the obturator is liberated from the carrier by unscrewing the lower screw. (The suture may now be tied over the obturator.) If the ligation is to be made above the knee of the sinus it will be necessary, in addition, to perforate the tentorium cerebelli with the needle.

The upper portion having been obliterated, and all downward current of blood stopped, the lower portion of the sinus is easily ligated, as the sinus walls are here much nearer; or if the bony exposure is low enough the lower portion of the sinus may be obliterated by the pressure of a tampon against its firm bony wall. Between the two ligatures the sinus can be incised.

Local Anesthesia. During the war local anesthesia grew in favor with some of those who were operating upon gunshot wounds of the head. Many of the subjects were in states of more or less profound shock and to be able to dispense with the administration of a general anesthetic, especially if the anesthetist was unskilled, was considered of advantage to the patient. The region and the nature of the operation rather lent itself to local anesthesia. A limited area for the field of operation could easily be blocked off with novocain, the periosteum could be infiltrated, the bone is insensitive and the dura also for all practical purposes. Add to this a patient in shock, with sensorium more or less benumbed and the problem was still further simplified. Martel³⁹ was most enthusiastic over his experiences in the military hospitals with local anesthesia and his enthusiasm carried him on to the surgery of brain tumors. He has applied this technic with, to him, most gratifying results in the removal of tumors of the cerebrum and even to tumors of the cerebellopontile angle for the removal of which he has operated six times. Of the advantages of local, as compared with general anesthesia he mentions the following: (1) It permits of the patient being placed in a position convenient to the operator, (2) it permits the subject executing any movement which will facilitate the operator, (3) it permits of the head being elevated, thus minimizing hemorrhage, lessening intracranial tension and not increasing arterial tension as with ether anesthesia. The head can be elevated quite as well under ether anesthesia if a suitable table is available; in fact, I have used the head-up position for pretentorial growths for many years. There is no doubt that the mechanical steps of a craniotomy and of subsequent exploration can be painlessly executed, but I am not at all sure that in the interests of the patient it is either wise or humane to carry out a long and tedious procedure in a state of consciousness. If left to the choice of the patients, the majority would, I am sure, prefer ether anesthesia. If there is any question of the patient's condition not justifying the completion of an operation under a general anesthetic, I have frequently divided the operation into two stages: the first under a general anesthetic, uncovers the suspected region and the flap is replaced and closed temporarily, while at the second sitting under local anesthesia or none at all the flap is again reflected and the search for and removal of the growth accom-

³⁹ Bull. et Mem. de la Société de Chirurgie de Paris 44, No. 2, p. 1364.

plished. By this plan the possible shock of a prolonged operation under a general anesthetic is avoided and for patients whose condition is not favorable to a major undertaking, the plan has distinct advantages.

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THE NOSE.

Rhinophyma. This disfiguring and repulsive affection is the most advanced stage of acne rosacea. Pathologically, it is a hypertrophy of the connective-tissue elements of the skin, the sebaceous glands and bloodvessels. When the final stage is reached, nothing but surgery will effect a cure. Two papers appeared last year, one by Gibbon⁴⁰ and the other by Fuld.⁴¹ The former advises excision of the lobules and the paring or shaving of the hypertrophied skin until the nose has assumed the size and shape which might be considered normal. Bleeding is minimal. The entire skin should not be pared away as this delays healing and assists in the formation of scar tissue. Fuld's method is more formidable: Under general anesthesia, an incision is made down to the cartilage in the median line of the nose, and a second incision all around the growth from the midline outward. The forefinger of the left hand is now inserted into the left nostril, with the palmar surface forward as a guide. The median edge of the tumor mass is grasped with mouse-tooth forceps (assistant to hold these) and all the diseased tissue, including the entire left lower half of the nose with the whole thickness of the skin is dissected off with a knife, the bony and cartilaginous framework of the nose being exposed. The hemorrhage is controlled by pressure with hot pads or forceps and ligations, if necessary. The foregoing steps are repeated on the right side. It is important to leave a little skin near the opening of the nares to avoid subsequent contracture with a resulting stricture.

The final step in the operation demands considerable care, as the skin graft should be applied in one large piece, if possible. Short nasal tubes are inserted into the nostril, and the nose dressed by carefully covering the graft with several layers of silver foil. A gauze dressing is applied, which is held in place with adhesive plaster, and allowed to remain undisturbed for six days.

THE SALIVARY GLANDS.

Postoperative Parotitis. Several papers on this affection press forward for our consideration. When postoperative parotitis has occurred, it has usually followed an abdominal operation, very rarely operations on other parts of the body. Among the causative factors are conditions which bring about relative dryness of the oral cavity, such as high temperatures in septic states and cessation of mouth feeding, since with the diminished salivary secretion the activity of the bacteria present in the oral cavity is greatly increased and their invasion of the gland through Stenson's duct is made relatively easy.

⁴⁰ *Annals of Surgery*, 1919, lxx, 169.

⁴¹ *Journal of the American Medical Association*, 1919, lxxii, 1734.

Deaver⁴² calls attention to the trauma inflicted by the anesthetist when the jaw is brought forcibly forward, the fingers being pressed against that part of the gland which extends downward behind the angle of the jaw into the neck. He believes that the complication occurs most frequently after operation on "dirty bellies." Collins⁴³ believes that the infection usually ascends the ducts, favored by a dry condition of the mouth and a lack of fluids in the body, and this is one of the accepted theories. Rolleston and Oliver, in a study of 1000 cases of gastric ulcer, *medically treated*, conclude that parotitis may occur as an outcome of the dry condition of the mouth in oral starvation. One of the best expositions of this affection in recent years will be found in the paper by Fisher.⁴⁴ He concludes: (1) That septic parotitis is of hematogenous origin. (2) That cachexia and malnutrition by lowering resistance are predisposing factors. (3) That susceptibility of gland is favored by stasis. (4) That secretion of the gland is under the influence of nerve stimuli and that the incidence of postoperative parotid involvement is neurologically dependent upon surgical shock or inhibition of the secretory and trophic fibers from higher psychic centers. (5) That the gland must be susceptible to pyogenic microorganisms, and, when affected, bacteremia exists in all cases. Cope⁴⁵ reports 7 cases of acute necrotic or gangrenous parotitis occurring in Bagdad. His observations on operative treatment will be referred to later. Collins comes to the conclusion that his patients had not received sufficient fluids, that there was inactivity of the parotid glands with dryness of the mouth, and that the inactivity of the glands predisposed to infection. A study of the practical results of trying to give fluids per rectum convinced him that the patient did not get nearly as much fluid by that method of administration as he had tried to make himself believe. He found that about half of the patients retained very little, if any, of the fluid, and the remaining patients retained perhaps half of the fluid administered. After two or three days' administration the rectum usually became irritable and retained none of the fluid. He therefore decided that the first problem was to keep the parotid gland actively secreting and passing a current of secretion down Stensen's duct into the mouth; and the second was to keep the patient's body supplied with sufficient fluid.

He therefore excites the secretion of the mouth and keeps a current of saliva running down Stenson's duct by allowing the patient to suck on a stick of lemon candy after operation. Fenwick⁴⁶ advocated the sucking of a rubber teat.

If operation is needed, the incision of Lilienthal⁴⁷ or of Blair⁴⁸ should be used. "The surgeon must not count upon finding fluctuation. Owing to the very close texture of the parotid, the pus infiltrates into the

⁴² *Annals of Surgery*, 1919, vol. lxi, p. 128.

⁴³ *Surgery, Gynecology and Obstetrics*, 1919, vol. xxviii, p. 404.

⁴⁴ *Annals of Surgery*, 1919, vol. lxx, p. 713.

⁴⁵ *British Journal of Surgery*, 1919, vol. vii, p. 130.

⁴⁶ *British Medical Journal*, 1909, vol. i.

⁴⁷ See *PROGRESSIVE MEDICINE*, March, 1918, p. 58.

⁴⁸ *Medicine and Surgery*, 1917, vol. i, p. 134.

glandular tissues, creates little multiple pockets and only exceptionally collects. A single incision sometimes is sufficient, but often multiple incisions are necessary. By making the incision as retrograde as possible and toward the sternomastoid, the scar will be less visible and injury to the facial nerve will be avoided. After section of the skin, the bistoury should be replaced by the cannulated sound." (Fisher.)

Cope advises a more extensive procedure: In planning the incisions, one must remember that the main mass of the gland swelling is around the angle of the jaw, and that separate openings are needed for the upper part of the gland and for the portion which lies against the mastoid process.

The incisions which he has found useful consisted of a large J-shaped cut at the angle of the jaw over the maximum swelling, a subsidiary incision—straight or J-shaped—in front of the auricle, and a straight cut behind the auricle over the mastoid process. If the mastoid incision were not made at first, it was always needed later. Through these incisions the gland can be thoroughly explored and opened up, and, if thought fit, rubber drainage-tubes can be inserted to prevent the deep parts from closing together and thus prevent drainage. The necrotic gland substance bleeds very little, but occasionally vessels in the surrounding tissues need ligature.

Operative and Radium Treatment of Parotid Fistula. Last year I gave a brief resumé of the papers of Pietri and Dieulafe. These papers are now accessible⁴⁹ in English. This year I note the excellent little article by Cole⁵⁰ based on an experience of 16 cases. He rightly condemns the old seton operation. He also disapproves the operation described last year⁵¹ whereby atrophy is produced by resection of the auriculo-temporal nerve. He likens it to the procedure of the plumber who would remedy a leak in a pipe by cutting off the water supply to the house.

Cole's operation for *complete duct fistulæ* is as follows: A curved incision was made with convexity downward and a small flap reflected upward. This displayed the duct, the distal end of which was ill-defined and buried in scar tissue. A small lateral hole in the duct marked the limit of patency. The duct was then freed, its terminal portion resected, and two very fine catgut traction sutures were passed through its walls. The mucous membrane covered by buccinator was then made prominent immediately in front of the masseter by means of a small swab pressed against it from inside the mouth, and a small longitudinal incision was made through it into the mouth. The masseter was nicked at its anterior border and the margins of the wound.

Through the aperture thus created the stay sutures were passed and the duct was gently pulled into the funnel-shaped extension of the oral cavity. The duct was buried in the extension and the extension cut off from communication with the exterior by catgut sutures. The skin wound was then sewn up, drainage being established through a

⁴⁹ *Annals of Otolaryngology and Rhinology*, 1918, vol. xxvii, p. 1333.

⁵⁰ *Lancet*, 1919, vol. i, p. 971.

⁵¹ *PROGRESSIVE MEDICINE*, March, 1919, p. 68.

small stab incision. Each stay-suture through the duct was then made to take a good hold of mucous membrane inside the mouth, so that, when tied, the duct was secured in place. In both cases slight suppuration with a discharge of saliva occurred about the tenth day. Communication with the mouth had, however, been well and visibly established and firm healing occurred in a few days. Both cases were kept under observation for three weeks and were then discharged as cured. No branches of the facial nerve were identified and no facial paralysis occurred.

Cole introduces a rather new idea in the treatment of these cases. Should healing be delayed, the application of radium or x-rays is indicated; he states that *gland fistulae* and *incomplete duct fistulae* have never failed to respond to radiations. He permits exposure to a penetrating radiation from 200 mg. of radium contained in platinum tubes of a thickness of about $\frac{1}{4}$ mm.; in addition, 3 mm. of lead were employed to cut off all or nearly all of the hard beta radiation and to allow of the gamma radiation being used. The radium tubes were enclosed in rubber tubing and in addition several layers of lint were used on the skin to cut off any secondary radiations from the metal filters. An exposure of three to four hours was given to each skin area. In 1 case each area received six hours' exposure. The variation in the time factor was estimated on the condition of the tissue in each case, those with considerable induration of tissue receiving longer exposures. No marked reaction was obtained in any of the cases treated. In a number of patients x-rays were combined with the radium treatment, small doses being given at short intervals; the x-rays were filtered through 2 cm. of aluminum.

THE JAWS.

Bone Grafting. The most important contributions from the "war surgery" of the jaws which may be applied to civil surgery are those relating to the treatment of ununited fracture by bone grafts. Pseudoarthrosis may be marked by a close approximation of the bone ends or by a wide gap. In the former case, Imbert and Réal¹² have shown us that simple osteosynthesis is sufficient. The involved area is exposed by a curved incision, the bone ends freed of all cicatricial tissue and freshened and squared by means of a burr. The fragments are then wired or plated and the upper and lower teeth fixed in occlusion with brass ligatures and kept fixed for about two months.

Where the gap is appreciable, bone grafting must be used. Free tibial, rib, ilium, or scapula grafts, pedicled grafts, and cartilage grafts have all received attention. All those with experience agree: (a) That bone grafting cannot be safely undertaken in less than six months from the date of injury; (b) operation should be performed only in the absence of any inflammatory or pathological condition in the region; (c) communication of the mouth cavity with the wound must be avoided; (d) it is indispensable that as perfect immobilization as possible be assured by apparatus fixing the lower teeth to the upper.

¹² Marseilles méd., 1916, vol. liii, p. 193.

Powers⁵³ reported the results of 11 operations by the free tibial graft method. There were 7 cases of complete success (63 per cent.) and 3 failures (27 per cent.); the result in 1 case was undetermined. The grafts were cut with the Albee saw.

French surgeons seem to favor the method of Delangenière, described in detail by Lebedinsky and Virenque.⁵⁴ These authors report 15 cases treated by this method of which 9 have been absolutely successful, 2 showed slight mobility only at the end of five months, 1 failed owing to the refusal of the patient to submit to immobilization, while 3 are of recent date.

The essential feature of this method is the removal from the tibia with the chisel of a very thin shaving of bone covered with periosteum, the graft thus containing all the essential elements for osteogenesis. The grafts are easily manipulated and can readily be trimmed to proper size and shape. Thick bone grafts are much less satisfactory. It is well known that in most cases the grafted bone does not live, but plays an entirely mechanical role, and, in order for consolidation to occur, the osteogenetic activity of the extremities of the fragments must be solely relied on. The removal and placing of the graft are much more difficult than in the osteoperiosteal method, and require a special instrumentation. In the osteoperiosteal method, the ends of the fragments are exposed in the usual manner, the soft tissues being stripped away from each fragment to form a pocket about a centimeter deep. Usually three pieces of graft are employed: One is placed on the inner side of the fragments, with its periosteal surface away from the jawbone, its ends resting in the pockets in contact with each fragment; a second piece is placed along the line of the lower border of the mandible, periosteum down; the third is placed on the outer surface of the gap, its bony surface facing that of the inner graft. No fixation of the grafts is required, other than that afforded by suturing the deep tissues over them and the immobilization of the fragments by splints on the teeth. Occlusion of the teeth is maintained for three months. At the end of this time, examination is made to determine the firmness of the union. If there is still slight mobility in the callus, it is wise to replace the apparatus for a time. Consolidation is usually complete within three to five months.

Munby and Shefford⁵⁵ at first used a graft cut from the crest of the ilium but later preferred the pedicled graft of Cole which was described last year,⁵⁶ because of the shortening of time between the actual operation and the establishment of union. They found that bone-grafting operations give the best results when there are teeth in both fragments, which can then be completely controlled by a splint. In 9 cases of such a nature all were united at the end of ten months, with the exception of the earliest one, giving 89 per cent. of complete success. In those cases in which there is an absence of teeth in the posterior fragment, the operation is only indicated when the pseudo-arthritis is very lax, and marked

⁵³ *Annals of Surgery*, 1919, lxx, 476.

⁵⁴ *Prothèse et chir. cranio-maxillo-faciale*, 1918.

⁵⁵ *Lancet*, 1919, vol. i, p. 1070.

⁵⁶ *PROGRESSIVE MEDICINE*, March, 1918, p. 72

improvement can be obtained, even if union of the graft is imperfect. When there is already firm fibrous union causing little or no disability, the operation is not indicated.

Certain cases in which there is a large gap between the fragments are not suitable for a pedicle graft, especially when both ends of the fragments are pointed. In such instances a free graft is preferable. In free grafts the best results are obtained when the graft can be wedged into position and the periosteum stitched with fine catgut.

Cole and Bubb⁶⁷ have extended the pedicled graft method and offer the following conditions as essential:

1. *Site of Fracture.* The loss of tissue must implicate the horizontal portion of the bone—that is, the lesion must be situated at or in front of the angle.

2. *Size of the Gap.* This should usually not exceed 4 cm. In favorable circumstances it is possible to cut a thick, well-nourished graft of 6 cm. in length, and a gap of 5 cm. (before trimming) may thus be dealt with, if end-to-end union is resorted to.

3. *Condition of the Soft Parts.* It is necessary that the tissues of the submaxillary triangle should be free from scar tissue on the side from which the graft is to be cut. It is extraordinary how frequently this area escapes even when the soft tissues of the face are extensively damaged. They practice what we call the "Lane technic," and vary from the technic previously described by perforating the graft posteriorly and passing the fixing wire through the substance of the bone instead of surrounding it, thus insuring firmer and more reliable contact.

Thirty-four cases have been dealt with by this method and in 23 the result is known; of these, 21, or over 90 per cent., have been successful. Cole and Bubb also discuss their experience with the free transplant. They state that the size of the gap is not material as an isolated factor. They have successfully dealt with a case in which the graft, 7 cm. in length, extended from the facial vessels on one side to those on the other. The condition of the fragments is most important, both as regards reparative power and the facilities afforded for efficient immobilization. The ends of the bone always tend to become atrophic and sclerosed. This process is progressive, and hence any undue delay seriously diminishes the chance of success. The age of the patient, too, is a most important factor. Delay, then, on both these counts is to be deprecated. So convinced are they of this that they urge operation after a reasonable trial of more conservative methods. This is a question that vitally affects the welfare of the pensioner. The treatment of old non-unions brooks no delay, for every day that passes steadily diminishes the chances of success. The edentulous fragment is an even more burdensome difficulty than in the case of the pedicled graft. If they were asked to state what single item in the statement of jaw cases had given rise to the most difficulties, disappointments, and failures, they would unhesitatingly answer—the indiscriminate extraction of teeth.

⁶⁷ British Medical Journal, 1919, vol. i, p. 67.

The experience of Cole and Bubb is summarized in the following table:

Nature of operation.	Number of cases.	Result known.	Failure.	Success.
Plating	2	2	2	0
Wiring	20	20	1	19
Pedicled graft	34	23	2	21
Free transplant	12	10	3	7
Operation abandoned	3	3	3	3
Total	71	58	11 or 19%	47 or 81%

Ankylosis of the Jaw. Last year I abstracted the paper by Henderson and New in which they presented an admirable method for reaching the

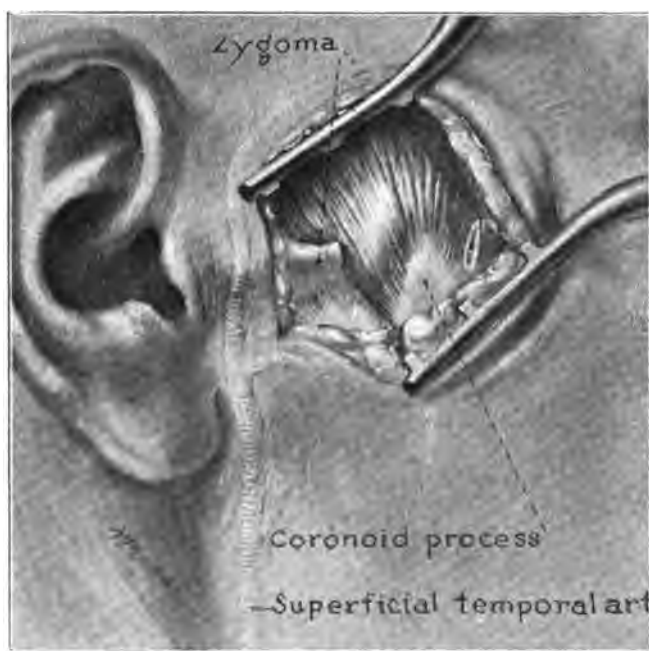


FIG. 13.—Appearance after removal of a portion of the zygoma and exposure of the coronoid process, and the attachment of the temporal muscle.

ankylosed joint from above by removing part of the zygoma, when the ankylosis was of the intra-articular variety. The treatment of the extra-articular and articular-extra-articular types are much more difficult, and we are again indebted to New⁵⁸ for an excellent method of treating these also. The technic is as follows: The skin and superficial tissues were incised down to the temporal fascia. A mastoid retractor was inserted and the zygoma exposed well forward. In elevating the soft tissues over the zygoma, it is essential to keep close to the bone, thus preventing injury to the facial nerve. By means of blunt dissecting

⁵⁸ Journal of the American Medical Association, 1919, vol. lxxiii, p. 264.

scissors and a periosteal elevator the inner surface zygoma was freed so that a piece of it, 1 inch long, was removed with a Gigli saw (Fig. 13). This piece was placed in a warm, wet gauze sponge. The temporal muscle and coronoid process were then exposed and removed with a curved chisel and a bone-biting forceps. The attachment of the temporal muscle to the inner surface and notch of the ascending ramus was removed by blunt, dissecting scissors (Fig. 14). The temporomaxillary joint was exposed but not opened, and was found to be normal. The piece of the zygoma that had been removed, was replaced and sutured by catgut sutures, and the wound closed with catgut and dermal sutures. The following day the patient could open his mouth, and in a week's

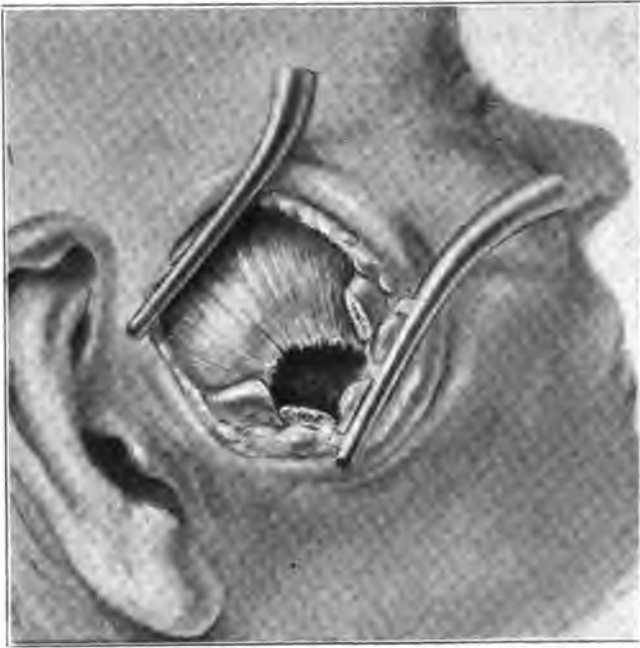


FIG. 14.—Appearance after removal of the coronoid process along with the attachment of the temporal muscle.

time he was able to separate his teeth one inch. The facial nerve was not injured. He was given a screwtop mouth-gag, but he preferred to use wooden tongue depressors placed together on the flat to exercise his jaws; he could put nine of these between his teeth. He was able to chew meat or any type of food. This good function of the jaw has been maintained now for four months.

Displacement of Mandibular Meniscus. Pringle⁵⁹ states that to his knowledge no method of reducing this displacement has hitherto been published. He effects this by hard pressure at the back of the condyle with the mouth open and then slowly closes the jaw. The method may

⁵⁹ British Journal of Surgery, 1919, vol. vi, p. 385.

need to be repeated several times but in 4 cases he has ultimately always succeeded. Reduction is felt by the patient, the sensation of a foreign body in the joint disappearing at once. In 1 case the disk continued to slip, rendering excision of it necessary. In this connection I would recall the operation of Blake described last year. Pringle's article is a complete exposition of the anatomical and clinical features of this affection.

THE LIPS, TONGUE AND MOUTH.

Macrocheilia. This interesting and usually congenital condition is but rarely discussed in the literature and the contribution by Moorehead and Dewey⁶⁰ is quite timely. If congenital, the malformation may be present at birth; in these cases the same disproportion of the size of the lip to the rest of the face remains as the child grows. Generally, the condition appears soon after birth or in earliest childhood. It may arise in women during pregnancy or at the menopause. The development is usually slow, one or both lips may be involved and macroglossia may be associated.

A satisfactory explanation of the etiology has not yet been given; lymph stasis is the immediate cause but whether due to failure of proper development of the efferent lymph vessels or to swelling of the endothelium or surrounding connective-tissue matrix is not clear. Moorehead and Dewey emphasize the importance of distinguishing the true lesion from a circumscribed lymphangiomatous enlargement. Neither do temporary swellings resulting from trauma or inflammatory processes belong to this group.

The operation for correcting macrocheilia is not difficult. Unless, however, it is intelligently performed, deformity may result. The lips are clamped with a lip-clamp to prevent hemorrhage, which is profuse. The mucous membrane is opened by two parallel incisions the entire length of the lip, and a small section of tissue removed. By careful dissection the excessive lymph tissue is removed until the lip has been reduced to normal. The wound is closed with a figure-of-eight horsehair suture, the first loop closing the deep structures and obliterating dead spaces, and the second loop closing the mucosa. If horsehair is used in this fashion, buried sutures are not necessary, and scar formation is reduced to a minimum.

Scar Tissue Tumors of the Lips. Bloodgood⁶¹ calls our attention to the occurrence of keloid-like growths in the lower lip after removal of a small portion of the mucous membrane or subepidermal tumor. The patient complains of pain or discomfort in the scar. In some cases operated on, lymph cysts and remains of mucous gland tissue were found in the granulation scar tissue. Bloodgood states that they have no relation to the nature of the primary lesion and are more apt to occur when the primary lesion has been treated with caustics or when the wound has healed by granulation. He does not advocate operative treatment.

⁶⁰ *Journal of the American Medical Association*, 1919, vol. lxxiii, p. 976.

⁶¹ *Surgery, Gynecology and Obstetrics*, 1919, vol. xxix, p. 340.

Plastic Repair of Wounds of the Face, Mouth and Lips. Among the many technical advances made during the war, none is more important than the facial plastics although lacking in the spectacular. Because most of us are not adepts in this branch of surgery, I have thought it worth while to reproduce parts of an excellent paper by Cole.⁶² The preliminary portion of his paper can be omitted. He used the open bite splint to prevent limitation of motion by the cicatrizing action of the healing wound and it is better for the surgeon to have a dental expert



FIG. 15



FIG. 16

control this part of the performance. His paper is presented in the form of a case report. In the first case the mucous membrane edges were freshened and united (Fig. 15) an open-bite splint with buccal flange being present at the time of operation. The skin edges were also freshened, and, by means of extensive undercutting and sliding, the outer aspect of the defect was closed. The patient developed a keloid scar and a salivary fistula which persisted for several weeks. Radiation improved the appearance of the scar and healed the fistula. The cosmetic result is moderately satisfactory, but, functionally, Cole regards it as by no means a success. That it is not functionally a total failure



FIG. 17



FIG. 18

is entirely due to the method of splinting adopted. The case forcibly illustrates my contention as to the essential difference between real and operative loss of tissue. Had the loss of tissue, depicted in the photograph, been fresh and cleanly cut, the measures adopted would have given a perfect functional result. The experience thus gained led to the employment of other and better methods in the treatment of similar lesions.

⁶² *Lancet*, 1918, vol. i, p. 11.

The next case of a similar type was dealt with as depicted in the diagrams. In Fig. 17 is illustrated the residual deformity—an open-bite splint is in position. A musculocutaneous flap was reflected up from the neck and united to the freshened mucous membrane margins of the gap, the lip line being first restored from the existing mucous membrane (Fig. 18). The skin surface of this flap was inward, its raw surface lay outward and was exposed. A sliding flap *A* was then fashioned from the lateral aspect of the neck and rotated to occupy a new position *A'*, its

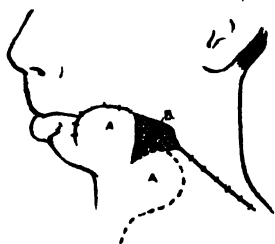


FIG. 19



FIG. 20

raw surface thus being contacted with that of the first pedicled flap, the redundant part of which is seen exposed at *B* (Fig. 19). A fistulous communication with the mouth necessarily existed under cover of *B*. This was closed at the same time as the redundant portion of the flap was turned back into the neck, the final result being shown in Fig. 20.

In another method the mucous membrane is replaced by skin obtained from the neighborhood of the gap, the flap being hinged and pedicled on its margins. This stage is shown in Fig. 21, together with the lines of incision for a pedicled flap and extensions to render easy the closure of the raw surface left by its reflection. In Fig. 22 the pedicled transferred

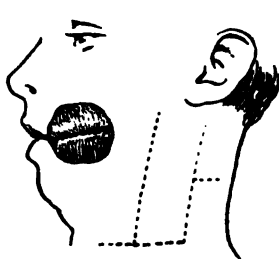


FIG. 21

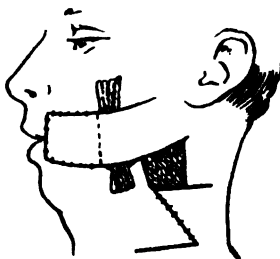


FIG. 22

flap has been swung into position and the lower part of the raw surface in the neck has been closed. In the final stage the pedicle has been divided and the redundant portion turned back to fill the place whence it was taken. This patient had sustained a very severe comminuted fracture which involved practically the whole body of the jaw. The functional result is perfect. This operation is one of two stages.

When the gap occurs farther back the operation may be completed in one sitting by utilizing a transposed flap instead of a transferred flap

with a free pedicle. In Fig. 23 is shown diagrammatically the condition of the patient previously referred to, after the primarily sutured wound had been incised to allow access to the fracture. Presenting in the gap



FIG. 23



FIG. 24

is the flange attached to the open-bite splint (Fig. 28, *a*). This man was very hairy, and therefore, as a preliminary to operation, the area around the gap was depilated by radiation outlined in dots. This area was then inverted as shown in Fig. 24, the stitch used being illustrated in

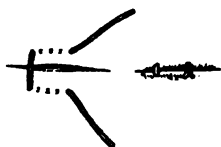


FIG. 25

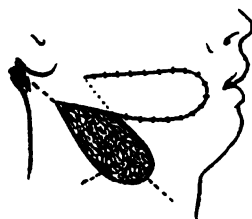
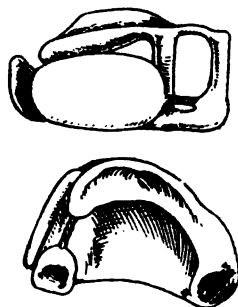


FIG. 26

Fig. 25. The raw surface this exposed was at once covered by a superimposed transposed flap (Fig. 26) and the raw surface in the neck obliterated by undercutting aided by extended incisions (Fig. 27). Other cases have been treated on similar lines with equal success. It is,



FIG. 27

FIG. 28, *a*

Cole believes, the first time that the depilating powers of radiations have been thus utilized by the plastic surgeon.

In some cases, however, owing to the size and situation of the gap,

such methods as those described are not applicable. For these cases, Cole has employed a doubly epithelialized flap, fashioned as shown in Figs. 29 to 33. The incisions in the neck are sketched in Fig. 29, the dotted lines indicating the ultimate area of the doubly epithelialized

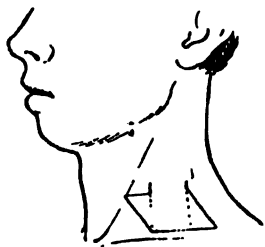


FIG. 29

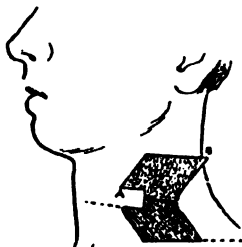


FIG. 30

portion. The flap is detached and thrown upward, as in Fig. 30, and additional incisions, shown by dotted lines, are made to facilitate obliteration of the raw surface thus left. The triangular areas lateral to the dotted lines are folded over and united to each other, the lines of union

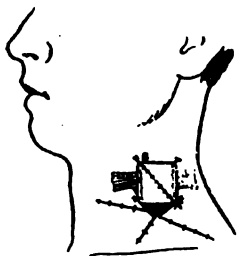


FIG. 31

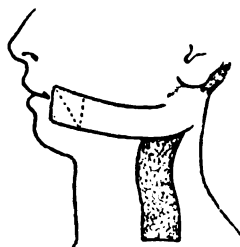


FIG. 32

being diagonal (Fig. 31). In this illustration the flap is shown stitched out on the skin of the neck with a small gauze pad inserted beneath it. The closure of the raw surface is also depicted. When union of the skin on the exposed surface of the flap has taken place,



FIG. 33

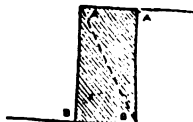


FIG. 34

the pedicle is extended upward to the necessary extent (Fig. 32). The free margins of the doubly epithelialized portion of the flap are then trimmed as in Fig. 33, thus defining two skin strata with raw edges. The margins of the gap are freshened, skin and mucous membrane being separately demonstrated. The deep skin margins of the flap are then

united to mucous membrane and the superficial skin margins to the skin of the face. At a later date the pedicle is cut and the redundant portion replaced in the neck. A convenient method of closing any rectangular

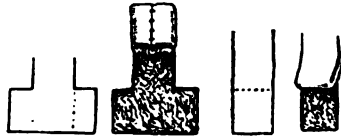


FIG. 35

FIG. 36

gap in the neck is illustrated in Fig. 34. Other methods of shaping doubly epithelialized flaps are shown in Figs. 35 and 36. He has utilized them all, but prefers that depicted in Fig. 29.

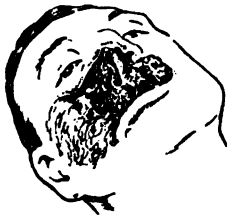


FIG. 37

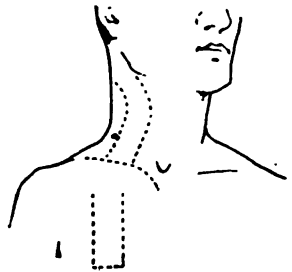


FIG. 38

In cases associated with extensive loss of the soft parts, it may be impossible conveniently to obtain sufficient tissue by utilizing one pedicle. In a case of this type (Fig. 37) that came under his care two pedicled flaps were reflected and dealt with, as shown diagrammatically

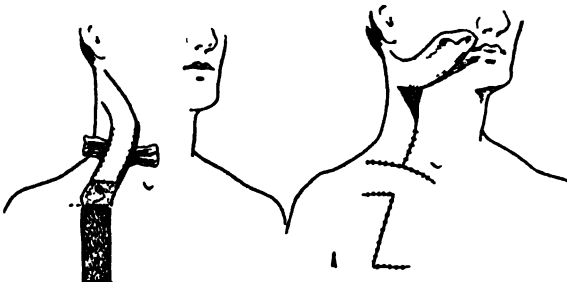


FIG. 39

FIG. 40

in Figs. 38 to 40. The large doubly epithelialized flap is shown in position in the photograph. The first time it was sutured it broke away owing to its weight and the small area available for attachment. It was sutured in position a second time and supported by metal arms let into a forehead

frame. When transferred to his care the patient's mouth was absolutely closed owing to the restricting effect of uncontrolled scar formation. He is now functional in every respect. The final result owes its cosmetic finish to the presence of an artificial nose and moustache. The patient has refused further operative treatment, as in his own terms, "he can do anything."

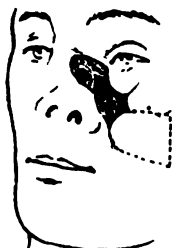


FIG. 41

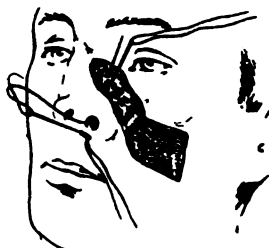


FIG. 42

Lateral Nasal Defects. Two cases of lateral nasal defects have been dealt with, as shown in Figs. 41 to 43. The nasal mucous membrane was replaced by rotating into the gap a hinged skin flap taken from the cheek (Figs. 41 and 42). The raw surface thus exposed was immediately covered by a pedicled scalp flap (Fig. 43). The two flaps, to prevent separation by fluid exuded from the raw surfaces, were united by mattress silkworm-gut sutures. Sites were chosen on the cheek flap before this was fixed to the deep margins of the gap. A threaded needle was

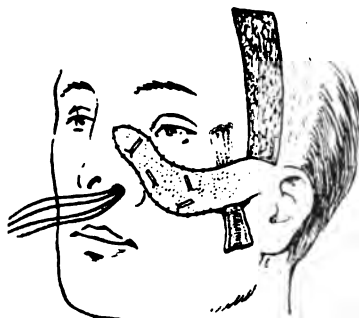


FIG. 43

passed from the raw surface and out through the nasal orifice where it picked up a small piece of rubber tubing to which was attached a long piece of thread. It was then passed back through the nasal orifice and through the flap, entering this from the skin surface (Fig. 42). The second half of the suture was completed by passing each end through the scalp flap and tying them over a piece of drainage tube on its skin surface (Fig. 43). The long threads hanging from the nasal orifice served to retrieve the pieces of drainage tube lying on the deep surface

of the united flaps when these mattress sutures were cut on the fourth day. Hair grew profusely on this flap, and depilation was done.

It is to be noted that the gap is not filled in, but merely bridged, thus exactly reproducing the normal state. The advantages of this method, aided by depilation, are obvious. It permits a hair-bearing scalp flap to be used to occupy a hairless area of the face. The scar area of the flap is completely hidden by growth of neighboring hair with resulting absence of disfigurement.

Cancer of the Tongue. In a delightful essay on this subject, D'Arcy Power⁴³ recounts the historical aspects quite fully. He considers that this disease is increasing in frequency, and at the present time more rapidly in men than in women, as the result of two causes—the first predisposing, the second exciting. The exciting cause is local irritation. The most effective local irritant is tobacco, although pyorrhea and carious teeth often act as minor exciting causes. The exciting causes may act for long periods of time, but will not produce cancer, except in the rarest instances, without the long-continued action of the predisposing cause—syphilis. The occasional occurrence of cancer of the tongue in animals and in non-syphilized people shows that, as in cancer generally, there is a *tertium quid* as yet undiscovered, which is called, for convenience, the predisposition to cancer. This predisposition manifests itself in the varying resistance to cancer shown by different persons. Sometimes the course of the disease is rapid, and an accidental injury to the tongue is quickly followed by a carcinomatous ulcer; at other times when every factor seems to be present and the individual ought to have cancer of the tongue, he lives to a good old age, and dies of some wholly different disease. A few papers only, discuss the surgical aspects. Rutherford-Darling⁴⁴ believes that an *early superficial* cancer of the free part of the tongue, if treated with due regard to modern principles, should be, and is, curable in practically every case. An early epithelioma, although attached to the underlying tissues, is typically a button-like surface growth, which is well defined and marked off from the adjacent tissues by an abrupt change of consistency. After a variable time, usually about two to three months, the epithelioma seems to pass a critical point, and begins to infiltrate the deeper tissues, while its outline becomes obscure. In other words, the button-like surface growth becomes converted into a tumor invading the substance of the tongue. It is in this early stage that epithelioma can be removed with a practical certainty of cure, while deeper extension increases the difficulty of obtaining this result.

If local malignancy were the chief difficulty in establishing a cure, it is obvious that once the distinction between the two forms of the affection is recognized, the operation results will improve, but, as is well known, the main difficulty lies in the involvement of the lymphatic glands. Hence, at the present day, a large number of patients are cured of their primary epitheliomatous focus, only to die miserably from glandular involvement.

Turning to the question of glandular involvement, if the involved

⁴³ British Journal of Surgery, 1919, vol. vi, p. 336.

⁴⁴ Medical Journal of Australia, 1918, vol. ii, p. 45.

glands remain hard and well defined, even though numerous, there is still the hopeful probability of cure, provided a thorough operation is performed. On the other hand, if the glands, although not necessarily large or numerous, are ill-defined, giving an inflammatory rather than a carcinomatous impression, then the chances of cure by any operation, however large, are remote. A dozen hard, sharply defined epitheliomatous glands are less serious than a single one of which the outline is obscure.

The prognosis of buccal carcinoma, therefore, should be based on physical signs rather than upon the duration of the disease.

Rutherford-Darling considers the anatomical arrangement of the lymph glands in detail and especially mentions the importance of the "interscapular gland" which lies in the posterior triangle with its anterior aspect touching the jugular veins. In 1909,⁶⁵ I abstracted the paper by Bonnot on the anatomical peculiarities of this "sponge" of lymphatic tissue. Rutherford-Darling rightly calls attention to the fact that epithelioma of the tongue is a spreading infection of lymphatic vessels and glands, but unfortunately the tongue cannot be divided up with more than approximate accuracy into different areas corresponding to a definite group of lymphatic glands.

In other words, no surgeon is able to prove that, in a given case, lymphatic extension has taken a certain course toward a certain gland group, and toward that group only; hence all operations for the disease should invariably include the removal of the regional lymphatic area. The same rule should apply when we have one of the glands of the regional lymphatic area involved by carcinoma, *viz.*, the removal of all groups primarily connected with the affected gland.

Now it has been shown that after the lymphatic stream has been blocked, as by carcinomatous invasion, the lymph may flow in any direction, and every sort of irregularity may occur in the further metastases; hence it behooves the surgeon in all cases of involvement of a member of the deep cervical chain to remove not only the regional lymphatic of the tongue, but also the whole of the deep cervical lymphatic glands.

The type of operation for the cure of epithelioma of the tongue should therefore vary according as to whether the regional glands are involved with carcinoma or not.

The remainder of his paper is devoted to a description of his application of the methods of Maitland and Ashhurst.⁶⁶

At the 28th Congress of French surgeons held in 1919, Sebileau⁶⁷ spoke particularly on the necessity of the extirpation of cancer as soon as it appeared. Unfortunately, it rarely happens that surgeons have an opportunity of seeing a cancer of the tongue in its initial stage. This is partly owing to the patient's indifference, since the cancer develops from an old leukoplakia that has been for a long period benign, and is partly ascribable to the fact that the physician frequently fails to recog-

⁶⁵ PROGRESSIVE MEDICINE, March, 1909, p. 60.

⁶⁶ Ibid., March, 1916, p. 75.

⁶⁷ Paris letter, Journal of the American Medical Association, November 29, 1919.

nize the syphilitic origin of the leukoplakia. Sebileau holds that the only proper treatment consists in surgical extirpation. Electrocoagulation and the use of physical remedial agents in general have failed utterly. Radium of itself is incapable of causing a cancer to disappear, and can only be regarded as exerting a supplementary action.

As regards the limitations of operability, Sebileau regards the following conditions as contra-indications: (1) Extension of the cancerous growth to the glosso-epiglottic sulcus and to the epiglottis; (2) invasion of the faucial pillars and of the tonsils; (3) profound infiltration of the mandible; (4) involvement of the two lateral halves of the tongue at the base, and (5) glandular hyperemia of the diffuse, inflammatory type. Before answering the question whether cancer of the tongue is curable or not, he called attention to the fact that in speaking of cancer it is always hazardous to talk of a cure. It is estimated that 40 per cent. of cancer patients operated on early survive beyond the three-year period. In old cancers and in those operated on by parietal or mandibular route, the percentage of recoveries is much smaller. However, even under these conditions some do recover, and though the number be small it is the duty of the surgeon to persevere in this line of surgery notwithstanding the fact that it is, as Sebileau admits, full of disappointments.

THE THYROID GLAND.

Certain recent studies indicate that goiter is more common outside of the Great Lakes region than is usually considered and also that males are more frequently affected than many reports would indicate. Smith⁶⁸ reports on the findings in 65,507 men passing through a physical examination at Jefferson Barracks. An enlargement of the thyroid gland was noted in 1074 instances (1.63 per cent.); 116 men were rejected with a diagnosis of hyperthyroidism or exophthalmic goiter, depending on whether or not exophthalmos was present.

In view of the statement sometimes made that goiter is rare among Indians, the observations of Kerr⁶⁹ are of some interest. Among 310 students of the Puyalup Indian School at Tacoma, Washington, 33, or 10.6 per cent., showed definite enlargement of the thyroid. Fourteen tribes were represented.

Levin⁷⁰ studied the thyroid occurrences in 583 registrants of Division No. 2 of Houghton County, Mich. He found that 177 of that number, or 30 per cent., showed a demonstrable enlargement of the thyroid, of which 140 (24 per cent.) were simple goiters, 23 (39 per cent.) were toxic goiters and 14 (24 per cent.) were large goiters of the adenomatous, colloid or cystic types of a disqualifying nature. By arithmetical computation Levin figures that, based on the above figures, there are 98,663 goiters in the upper peninsula of Michigan, of which 20,515 are large or toxic types.

⁶⁸ Journal of the American Medical Association, 1919, vol. lxxii, p. 471.

⁶⁹ Northwest Medical, 1919, vol. xviii, p. 110.

⁷⁰ Journal of Michigan State Medical Society, 1919, vol. xviii, p. 98.

Acute Thyroiditis. It has been some time since I have seen a paper upon this condition. Beilby⁷¹ reports 3 instances in a series of 99 goiter lesions, 2 of which resulted from a downward extension of an infection of the throat and 1 was caused by infection (hematogenous) of a degenerating adenoma. The symptoms of acute thyroiditis vary accordingly as the inflammation of the gland is a primary affection or arises in some lesion previously existing. In the former patients usually suffered from chills, malaise and headache, common to all infectious diseases. Pain is felt in the region of the gland, more pronounced on one side because the process usually begins in a single lobe, often radiating to the ear and side of the neck, lancinating in character, and greatly aggravated by extension of the head. As a result the attitude may be somewhat characteristic, the head bowed and held very rigid. Local swelling is rarely noticed early and is never a marked symptom. Difficulty in breathing and swallowing are present, the degree depending upon the severity of the infection and the extent of gland involvement. The voice may be affected, even absolute aphonia is seen and an irritative cough with slightly blood-stained expectoration or a true hemoptysis may be present.

Of these symptoms, Beilby states that the earliest, with the exception of pain, are those of tracheal and esophageal stenosis from pressure on these organs by reason of the restraint imposed on swelling by the deep cervical fascia. Another pathognomonic symptom is a stony hardness of the gland which is only like that of cancer, but the history and absence of fever in the latter disease should make differentiation of these conditions easy.

Acute thyroiditis complicated by suppuration should be treated by simple incision and puncture under local anesthesia. No extensive surgical measures, such as partial excision of the gland or removal of tumors or cysts, should be undertaken in the presence of the serious infection. The wound should be left completely open to ensure free drainage. Frankau⁷² reports 3 cases of suppuration with one death. One case was a sequel to measles, the others metastatic. Papers by Lahey and Dowd on this subject have been quoted in *PROGRESSIVE MEDICINE* (March, 1919, p. 82).

Adenoma of the Thyroid Gland. One of the most interesting phases of goiter pathology is the group termed adenomata. Plummer, in 1913, called attention to the fact that 23.3 per cent. of these tumors were accompanied by the symptoms of hyperthyroidism but usually without the exophthalmos. Such symptoms have variously been ascribed to pressure, and hence irritation and hyperplasia of the thyroid, or to causes independent of the goiter. Goetsch⁷³ studied 125 specimens of adenomatous goiters and found that except for a very few simple colloid adenomas, mitochondria was found in the cells in great abundance, indicating a functional overactivity. He therefore believes that the adenoma itself is responsible for the toxic symptoms and that these depend on

⁷¹ Albany Medical Annals, 1919, vol. xl, p. 173.

⁷² British Medical Journal, 1919, vol. i, p. 792.

⁷³ New York State Journal of Medicine, 1918, vol. xviii, p. 259.

the amount of secretion elaborated by them and the tolerance of the individual. An active growing adenoma produces a marked hyperthyroidism which may diminish and disappear as the growth degenerates into a cyst. A small adenoma may cause little trouble because the amount of secretion poured out relative to the body weight of the individual is not sufficient to be toxic, or because the individual manifests a tolerance to the toxin. This statement would answer the thought arising in one's mind as to why Plummer did not observe toxic symptoms for an average of years after the tumor was first noted by the patient. Probably we might imagine also that tolerance did not break down for an average of fourteen years, as in Plummer's cases.

Goetsch also states that if the symptoms disappear when an adenoma formerly active degenerates, a second wave of hyperthyroidism may occur when a new healthy adenoma arises, as is so frequently the case.

The Goetsch Test. Following up the study on adenomata and included in the same paper are the observations by Goetsch regarding the *reaction of the toxic thyroid gland to injections of epinephrin* (adrenalin). His interest was aroused by the observations of Barker and Sladen, Eppinger, and Hess and others, who, in the study of vagotonia and sympatheticonia, found that hyperthyroid individuals were sensitive to adrenalin.

Goetsch finds the test to be of the greatest value and help in the diagnosis of that large group of border-line cases resembling in some respects true hyperthyroidism, but without definite, recognizable signs on the part of the patient generally or in the findings of the thyroid gland, which may not be palpably enlarged. Many of these cases turned out to be adenomata, too small to be palpated before operation. After excision of adenomata the sensitiveness may persist, for one cannot with safety remove the entire thyroid gland.

In a later paper, Nicholson and Goetsch⁷⁴ attempted the differentiation of early tuberculosis and hyperthyroidism by means of the adrenalin test. Forty cases were studied and the problem consisted in separating the group presenting a syndrome similar to that of early tuberculosis in many respects, in whom, however, clinical tuberculosis is not proved. The syndrome of symptoms consists of fatigue, asthenia, loss of weight and strength, increased or normal pulse-rate, nervousness, and possibly slight elevation of temperature. Of the 40 cases, 18 were considered as belonging to the group in which clinical tuberculosis was questionable; 10 of these reacted positively to the adrenalin test. Sixteen cases were classed in the "clinical tuberculosis inactive" group; 9 showed a positive response to the adrenalin test. In group three consisting of 6 cases, with definite but moderately active clinical tuberculosis, the typical reaction to adrenalin was negative in all. They conclude that they were able to offer a means of determining whether the disease from which the patients are suffering is purely a tuberculosis; is tuberculosis complicated by hyperthyroidism; or pure hyperthyroidism.

As much interest has been aroused by this test the technic will be described rather minutely. Goetsch advises that the patient be put to

⁷⁴ American Review of Tuberculosis, 1919, vol. iii, p. 109.

bed the previous day and reassured that the test will be in no way painful or associated with danger. The usual history must be taken and the symptoms noted with great care. On the day of the test, the patient is placed as nearly as possible under normal conditions, but taking his meals in bed. Quoting directly from Goetsch, one should proceed with the test as follows:

"Two readings are taken, at five-minute intervals, of the blood-pressure systolic and diastolic, pulse-rate, and respiration. A note is made of the subjective and objective condition of the patient. This includes the state of the subjective nervous manifestations, the throbbing, heat and cold sensations, asthenia, and the objective signs, such as pallor or flushing of the hands and face, the size of the pupils, throbbing of the neck vessels, and precordium, tremor, temperature of the hands and feet, perspiration, and any other characteristic signs or symptoms noticed. These signs are all noted previous to the injection of the adrenalin so that comparison may be made after the injection.

A hypodermic syringe armed with a fine needle which, when inserted causes little discomfort, is then used to inject 0.5 c.c. (7.5 minims) of the commercial 1 to 1000 solution of adrenalin chloride (Parke, Davis & Co.) into the deltoid region, subcutaneously. Intramuscular and intravenous injections are not given. Readings are then made every two and one-half minutes for ten minutes, then every five minutes up to one hour, and then every ten minutes for half an hour or longer. At the end of one and a half hours the reaction has usually entirely passed off, sometimes earlier. The repeated early readings are made in order not to miss certain reactions on the part of the pulse- and blood-pressure that may come on in less than five minutes after the injection is made. This is particularly true in cases of active hyperthyroidism.

In a positive reaction there is usually an early rise in blood-pressure and pulse of over ten points at least; there may be a rise of as much as fifty points or even more. In the course of thirty to thirty-five minutes there is a moderate fall, then a slight secondary rise, then a second fall to the normal in about one and one-half hours. Along with these one sees an exaggeration of the clinical picture of hyperthyroidism brought out, especially the nervous manifestations. The particular symptoms of which the patient has complained are usually increased, and in addition there are brought out many symptoms which have been latent. Thus it is not uncommon to have extrasystoles brought out, after the injection of the adrenalin. The patient is usually aware of them and may tell one that she has felt this same thing a year or two previously, at which time the symptoms of the disease were more active.

The following may all or in part be found: Increased tremor, apprehension, throbbing, asthenia, and in fact an increase of any of the symptoms which the patient may have complained of. Vasomotor changes may be present; namely, an early pallor of the face, lips, and fingers, due to vasoconstriction, to be followed in fifteen to thirty minutes by a state of vasodilation with flushing and sweating. There may be a slight rise of temperature and a slight diuresis.

In order to interpret a test as positive, we have regarded it as neces-

sary to have a majority of these signs and symptoms definitely brought out or increased. Thus there is at times a considerable increase of pulse-rate without much increase in systolic blood-pressure. but with a considerable increase or exacerbation of the objective signs and symptoms, or there may be an increase of ten points in the pulse- and blood-pressure and a moderate increase of the symptoms and signs; or again, there may be only slight changes in pulse- and blood-pressure and considerable change in signs and symptoms. These may be regarded as positive. In a word, then, one must consider the entire clinical picture produced in order to gain a correct interpretation, just as in the disease itself one cannot expect every one of the characteristic signs and symptoms to be present in order to make a diagnosis."

Sugar Tolerance Test. It is well known that there is a disturbance of carbohydrate metabolism in a certain percentage of cases of hyperthyroidism. Following the methods of Janney and Isaacson and others, Smith⁷⁶ investigated 30 "suspects" at Camp Travis. His results were inconclusive but were suggestive.

The importance of such tests as the "metabolic rate," or the adrenalin test of Goetsch is apparent when we review the paper by Addis and Kerr.⁷⁶ A considerable number of soldiers in training were referred to their Board on account of the presence of a syndrome which included all or most of the following signs and symptoms: The signs were increased pulse-rate, tremor of the fingers and cold, moist hands which became cyanosed when dependent. The symptoms were precordial pain with dyspnea and palpitation on moderate exertion, such indications of vasomotor instability as dizziness, flushing, and fainting, and a variety of other complaints, all pointing to a state of excessive reaction of the nervous system to psychic or physical strain. These signs and symptoms have been frequently noted before, especially in the British literature, and called "Effort Syndrome," "neurocirculatory asthenia," etc.

The Board believed that the above symptoms would be found associated with a thyroid enlargement almost constantly. But such was not found to be true, and it was concluded that the development of toxic goiter is not the cause of the syndrome, even in men with enlarged thyroids.

Now, Wearn and Sturgis⁷⁷ studied the effect of epinephrin injections, after the method of Goetsch, in 73 soldiers suffering from "irritable heart," and found that about 60 per cent. reacted positively. They also found by careful clinical analysis as well as determinations of the basal metabolism that no support is given to theory that hyperthyroidism is an underlying features of this condition. In a second paper they bring out the important point that "with unbroken regularity the metabolism shows a rise after the injection of epinephrin."

Another interesting study of the "irritable heart of soldiers" has been published by Peabody, Wearn and Tompkins⁷⁸ who found that metab-

⁷⁶ Journal of the American Medical Association, 1919, vol. lxxiii, p. 1828.

⁷⁶ Archives of Internal Medicine, 1919, vol. xxiii, p. 316.

⁷⁷ Ibid., p. 247.

⁷⁸ Medical Clinics of North America, September, 1918, p. 507.

olism studies lend little support to the view that overactivity of the thyroid gland is a factor of importance in this condition. Of 57 cases, 24 were diagnosed hyperthyroidism by competent observers in 24 instances and yet none of these had a metabolism above normal.

Following up his earlier work with Peabody, Smith⁷⁹ tested 30 soldiers at Camp Travis with the Goetsch test. Those men who had a possible disturbed carbohydrate metabolism and who reacted to small doses of thyroid gland all responded to three-fold doses of epinephrin. Seven other men, however, who had a normal blood-sugar curve following the administration of glucose and did not respond to thyroid feeding (considered most reliable by Smith) also reacted positively to the epinephrin test.

The above observations should make us pause and check up our ideas of the clinical syndrome of toxic goiter and above all to properly evaluate these apparently most important tests—the metabolic rate and the epinephrin sensitiveness.

Classification in Hyperthyroid Cases. For those interested the following scheme of Hertzler⁸⁰ is reproduced. His paper is an interesting discussion of the different groups.

1. Adolescent:
 - (a) Stable nervous system without other lesion.
 - (b) Stable nervous system with other lesion.
 - (c) Neurotic.
2. Adult type:
 - (a) Normal nervous state without associated disease.
 - (b) Normal nervous state with associated disease.
 - (c) Abnormal nervous state.
3. Typical exophthalmic goiters:
 - (a) With associated lesions.
 - (b) Without associated lesions.
 - (c) Localized changes in the gland.
4. Secondary:
 - (a) With associated lesions.
 - (b) Without associated lesions.
 - (c) With pronounced myocardial changes.
5. Atypical:
 - (a) Acute classical hyperthyroidism.
 - (b) Acute masked hyperthyroidism.

Blood Picture. Plummer,⁸¹ basing his observations on 578 patients in the Mayo Clinic, finds the average Hb. to be 83.1 per cent., only 2.2 per cent. being below 70. Any anemia was not of the chlorotic type the reds averaging 4,790,000. The leukocyte count averaged 6973.5 but with a rather wide variation, probably dependent on the neutrophiles. He was not able to demonstrate a leukopenia in the early stages of the disease. He found a relative and absolute mononucleosis. The differential count, however, is of limited value in diagnosis.

⁷⁹ Journal of the American Medical Association, 1919, lxxiii, 1828.

⁸⁰ Surgery, Gynecology and Obstetrics, 1919, vol. xxix, p. 462.

⁸¹ Minnesota Medical, 1919, vol. ii, p. 330.

Operative Technic. The present trend of thought in regard to thyroidectomy is the tendency to remove large portions of the gland when the condition of the patient allows. Thus, MacLean²² states that he bases his operation on the research work of the University of Minnesota where it has been found that one-sixth of the gland is necessary in the adult and one-third in the growing animal. However, patients with exophthalmic goiter seem to do well when very little of the thyroid remains. In severe cases he aims at leaving the minimum amount of one-sixth of the gland, but in some of the less severe types somewhat more than one-sixth has been left.

This has been my own practice because we have all noted the hypertrophy of the remaining part, as pointed out by Halstead long ago. Richter²³ believes that the excessive reaction sometimes noted is based on a basic fault in the scheme of operation. A few grams of thyroid tissue suffice to carry on its function.

Another point in technic susceptible of debate is that of preliminary ligation. Several surgeons incline to the view that such is unnecessary, Richter stating that he has ligated in less than 10 per cent. of his toxic cases.

Noble²⁴ believes that to precede lobectomy by ligation is a tendency to err on the side of safety. He does not practice ligation of the vessels in any type of case preferring a rapid, thorough, and careful lobectomy. After preliminary ligation, rapid work and careful handling of the gland is impossible because of the erratic collateral circulatory changes, and the marked increase in the fibrous tissue ramifying and adjacent to the gland.

McGregor²⁵ advocates boiling water injections, asserting that they are as equally beneficial as ligation and of less shock to the patient. But Link²⁶ points out the serious objection to boiling water injections, viz., that thyroidectomy is made difficult by reason of the gland being held solidly in the neck, due to adhesions. Hemorrhage, also, may be severe. For these reasons Link limits the use of boiling water to two classes of cases: those in whom we never expect to be able to do thyroidectomy, and those who, after all vessels are ligatured, are still unfit for thyroidectomy.

I am still in favor of this method of procedure in severe cases and believe that the reduction in mortality in recent years has in part been brought about by preliminary ligation. Lahey²⁷ speaks very strongly in favor of preliminary pole ligation. He says that "to surgeons experienced in thyroid surgery, the warning, 'ligate when in doubt' is unnecessary; they have either been aided by the procedure in maintaining a low mortality, or have been forced to it by a high mortality. To men experienced in general surgery, but not particularly in the surgery of hyperthyroidism, the warning, 'ligate when in doubt,' will prevent

²² Surgery, Gynecology and Obstetrics, 1919, vol. xxix, p. 475.

²³ Journal of the American Medical Association, 1919, vol. lxxiii, p. 1264.

²⁴ Journal of the Indiana State Medical Association, 1919, vol. xii, p. 230.

²⁵ Canada Medical Association Journal, 1919, vol. xix, p. 406.

²⁶ Journal of the Indiana State Medical Association, 1919, vol. xii, p. 64.

²⁷ Boston Medical and Surgical Journal, 1919, vol. clxxxi, p. 618.

many a distressing table death, and but few surgical calamities are more harrowing than a death on the table while operating for hyperthyroidism. To the 'now and then' operator, I would only say, if your conscience permits you to operate upon cases of hyperthyroidism, preliminary ligation is one of the ways in which the mortality rate in partial thyroidectomy for hyperthyroidism can be lowered."

He favors pole ligation because (1) something short of one-half of the blood supply of the gland is immediately cut off; (2) there is produced an interruption of the impulses reaching the gland from the superior cervical sympathetic ganglion; (3) the lymphatics passing from the gland are blocked. He has found a constant gain in weight varying from a few pounds up to thirty pounds, an improvement in the nervous condition, a lowering of pulse-rate, and a relative approach toward a normal condition. After double pole ligation the patients are sent home for a period of eight weeks after which partial thyroidectomy may be done. He usually operates under a combination of scopolamine, morphine, novocaine, and gas. He locates the superior pole of the thyroid by palpation, and just above this makes a short transverse incision about $1\frac{1}{2}$ inches in length. If necessary to obtain an adequate exposure, the sternohyoid and sternothyroid muscles may be cut. Troublesome bleeding is often encountered, but is easily controlled; all vessels should be tied early so that the hemostats will not interfere with the exposure through the small opening. The pole is then surrounded by a ligature and care taken to include the posterior branch of the superior thyroid artery. The method followed by Link is as follows:

Draw an imaginary line vertically through the apex of the thyroid. Infiltrate with anesthetic solution directly across this line half an inch above the apex of the thyroid. Incise skin and platysma $1\frac{1}{2}$ inches so that the vertical line bisects the incision. The incision may be horizontal or may slant slightly downward and forward in a skin crease. The platysma and the cervical fascia being cut, the underlying muscles are separated in the direction of their fibers until the capsule of the thyroid is identified. If in doubt as to the capsule of the thyroid, ask the patient to swallow when the gland is seen to rise and fall. The capsule may be divided, and a branch of the artery easily found. As a rule, pulsation of the large branch lying at the posterior border of the thyroid cartilage is so plain at this step that nothing remains but to uncover it and trace it to its origin. A bloodless field is very necessary. To obtain this, use an excess of adrenalin and carefully tie all bleeders. It is best to tie the artery with chromic catgut No. 1. Silk or linen has invariably been expelled. Ligature in continuity. A small drain left in for a few days will save trouble.

Ligature of the inferior thyroid was brought forward by Halstead in 1913⁸⁸ but is rarely practised because more difficult than the ligature of the superior thyroids. The following method of Link, similar to that of Halstead is given to refresh our memories:

Slightly below the level of the cricoid cartilage, a horizontal incision,

⁸⁸ *PROGRESSIVE MEDICINE*, March, 1914, p. 92.

2 inches long, is made. The middle of this incision should lie directly over the prominence of the sternomastoid muscle. The skin and platysma being incised the fibers of the sternomastoid muscle are separated, as are also the fibers of the sternothyroid muscle, thus uncovering the thyroid capsule. The thyroid is retracted inward and very easily separated from the common carotid artery which is drawn outward. When the posterior surface of the common carotid artery is reached, the pulsation of the inferior thyroid artery may often be seen at the level of the cricoid cartilage. For a deep landmark it is noted that the artery crosses inward from behind the common carotid artery just below the carotid tubercle of the sixth cervical vertebra. This operation, even more than that of ligature of the superior thyroid, must be free from bleeding. The recurrent laryngeal nerve usually lies directly behind the inferior thyroid artery, which crosses it. The sympathetic trunk and its cardiac branches are sometimes seen and should not be injured. The artery lies at a considerable depth from the surface and special retractors are necessary as well as a ligature carrier of the proper shape and length. The most important detail is perhaps that of the lighting.

Link offers what I believe to be a new point in technic, namely, the simultaneous ligature of the superior and inferior arteries through one incision. He begins as mentioned above and ligates the inferior vessel, if the patient's condition is good, the upper flap is strongly lifted upward and the superior is dissected out. The arteries lie in different planes but their vertical positions are not so far apart as commonly supposed. These arteries have been found to be subject to considerable and frequent variation. The superior arteries may both be very small, the inferior arteries being correspondingly larger than usual or *vice versa*. Even when such a variation is present, the ligature of both the superior and the inferior artery at one sitting assures control of one-half the blood supply of the gland. Ligature of two arteries through the same small incision seems to be borne as well as ligature of one artery and gives a greater relief. It has been found that ligature on both sides at a time is not safe in severe cases. Ligature of the inferior thyroid artery is by far the preliminary operation of choice. The technic of ligature of the thyroid arteries is hard to learn from the surgical and anatomic literature. The anatomy of the inferior thyroid artery, especially, is seldom illustrated correctly.

Recurrence of Exophthalmic Goiter after Thyroidectomy. Sloan⁸⁹ calls attention to the importance of eradicating focal infections, which may cause a persistence of certain symptoms such as a mild tachycardia, pyknicardia, lack of nervous stability, etc., after apparently successful operations. The mouth, throat, nasopharynx and teeth are the most important factors. He prefers to eradicate these focal infections first or as soon as possible after the ligation or lobectomy. Porter⁹⁰ states that to allow focal infections to remain after thyroidectomy is to invite a recrudescence of the goiter symptoms. He adds that thyroidectomized patients are especially vulnerable to these infections.

⁸⁹ *Surgery, Gynecology and Obstetrics*, 1919, vol. xxix, p. 148.

⁹⁰ *Ibid.*, vol. xxviii, p. 431.

Dangers from X-ray Treatment of Toxic Goiter. Most of the papers relating to this method of treatment of hyperthyroidism insinuate that the x-ray treatment is not only almost certain to cure or effect great improvement, but is without danger and in this way compares most favorably with surgery. It is refreshing, therefore, to note the statements in a recent paper by Holmes and Merrill⁹¹ on the dangers incident to x-ray treatment. The paper is easily acceptable and no doubt has been read by most of the readers of these pages. The subject is treated fairly and conservatively, and of course advocates the use of the rays in this disease.

Holmes and Merrill state that the function of the thyroid gland may be destroyed if the treatment is pushed too fast and a state of hypothyroidism produced. They believe that changes go on in the gland for some time after treatment is discontinued. Another undesirable feature is that of telangiectasis and atrophy in the regions treated, but these can be avoided by using heavy filters and keeping well below with an erythema dose. Finally, they state that the toxemia may be increased to a dangerous degree by the first treatment, especially when surgical treatment has been previously employed without success, x-ray treatment should be given with the utmost caution. In one of the Swedish Journals, Secher reports the case of a patient with exophthalmic goiter whose condition was so aggravated by eight roentgen exposures that death occurred. Secher reports finding two other cases in which the aggravation of symptoms was so intense that the patient died.

Cancer of the Thyroid Gland. A number of years ago (1906) Müller and Speese published an extensive paper upon malignant disease of the thyroid gland and reported a number of cases from our University Hospital including some from my clinic. They found from their study that the mortality including both the operative mortality and the deaths from a speedy recurrence within a few months should be placed at 70 per cent. *at least*. The recent paper by Balfour⁹² based on the experience of the Mayo Clinic shows a total of 65.6 per cent. deaths, or probable early death from the disease. The incidence is 1.19 per cent. of 14,456 patients with goiter. The most important lesson which he draws is that in 46 per cent. no clinical manifestations of the disease were in evidence. This group shows by far the highest percentage (about 70) of patients free from recurrence at the present time. In other words, the great majority of apparent cures have occurred in those cases in which the malignant change was an unexpected finding. Total thyroidectomy was rarely performed in this group. In most instances the lobe containing the tumor and the malignant process was removed, but in many the enucleation of an adenoma was the procedure. The analysis showed also that when clinical evidences of cancer are present, the results of surgical treatment are discouraging. Total extirpation of the gland appears to be indicated only when both lobes are grossly involved in the disease, and when past experience warrants surgical interference in the

⁹¹ Journal of the American Medical Association, 1919, vol. lxxiii, p. 1693.

⁹² Medical Record, 1918, vol. xlv, p. 847.

particular case. Recognizable involvement of cervical glands usually means that the time for surgical cure is past.

The last lesson which he draws from his study is that the average number of years of abnormal growth in the thyroid preceding the operation was 11.6, this being proof positive of the advisability of the early removal of well-developed thyroid nodules—the precancerous condition of the thyroid. Another interesting observation is that the cancer has never developed in a distinctly and purely hyperplastic gland. Eight of the cases occurred in individuals under thirty years of age.

THE NECK.

Hodgkin's Disease. The literature upon this subject seems to be confined to the papers of Levin³³ and Burnham.³⁴ The former states that the main features of Hodgkin's disease set it apart from any known parasitic or inflammatory disease. Both writers emphasize the difficulty oftentimes experienced in distinguishing between Hodgkin's, lymphosarcoma and tuberculosis, and the fact that there is a very close relationship between them. Sometimes one lymph gland may appear to be microscopically characteristic of Hodgkin's disease while another will show a condition of tuberculosis. It seems most likely that Hodgkin's disease does not begin in a normal lymphoid system. Tubercle bacilli or some other infectious agent produces an inflammatory lymphoma, and subsequently an unknown etiological agent transforms the latter into a malignant lymphoma. When all the types of cells within the gland proliferate, the condition is one of Hodgkin's granuloma. When, possibly as a matter of simple accident, one type of cells dominates over the others, there develops a condition of lymphosarcoma. The latter condition is no more identical with a true sarcoma than the Hodgkin's granuloma itself. Levin states that the chief characteristic in Hodgkin's disease is unlimited proliferation of the cells of the lymph glands, and in this respect it is clearly analogous to cancer; but with this the similarity of the two conditions ends. Hodgkin's disease, once developed, is a systemic disease which embraces the whole organism. Not only the visibly enlarged lymph glands or spleen of a Hodgkin's patient are abnormal, but also the rest of the lymphoid tissue within the organisms; even the glands that do not appear to be enlarged or abnormal are undoubtedly affected with the same disease. Lymphosarcoma is only a type of Hodgkin's granuloma and also consequently only one manifestation of a systemic disease. A secondary lymphosarcomatous tumor which develops at a distance from the primary one is not formed through the transportation of cells from the latter, but originates in the lymphoid cells of the region involved.

Round-celled sarcoma of a lymph-gland may be indistinguishable microscopically from a lymphosarcoma, but like any other sarcoma or carcinoma the former develops locally, is not a systemic disease, and produces true metastatic tumors. Unlike cancer or sarcoma which (not

³³ *Annals of Surgery*, 1919, vol. lxx, p. 561.

³⁴ *Surgery, Gynecology and Obstetrics*, 1919, vol. xxix, p. 440.

lymphosarcoma) should be treated by operative removal, Hodgkin's and lymphosarcoma, according to both Levin and Burnham, should be treated by radium and x-rays, surgery having no place except to obtain material for diagnosis. The former believes that Hodgkin's glands and lymphosarcomata are more promptly influenced by radium and x-rays than any other tumor. The affected lymph glands diminished rapidly in size, and with it there is a marked improvement in the general condition of the patient. Besides the affected lymph glands, the spleen should be subjected to the same treatment.

Levin has shown in a previous publication that carcinoma or sarcoma under the influence of radium or x-rays may be replaced by dense connective tissue. It is possible that when radium and x-ray treatment of Hodgkin's or lymphosarcoma is begun early and kept up for a sufficient length of time, the spleen and lymph glands undergo a somewhat similar change in structure. As a consequence, the overproduction of unripe forms of lymphocytes may be permanently inhibited, irrespective of whether the rays produce any effect on the unknown etiological agent of the disease.

The treatment of these conditions should continue for months. Should the treatment be interrupted for a time, then at first evidence of a new enlargement of the glands the treatment must be repeated. The opinion prevails that the action of the x-rays is only palliative and that ultimately the patients fail to respond to treatment. These unsatisfactory results are probably due to the fact that radium and x-ray treatment is attempted only late in the course of the disease and is not pursued with sufficient energy. In a few early cases, Levin succeeded in arresting the disease for a number of years.

Burnham prefers radium but uses x-ray where the former is not available. Chronic cases are more favorable than acute. Intensive prolonged exposures very satisfactory in some chronic cases, are quite unsuitable in acute cases.

In a chronic case limited to one set of glands, a single exposure may lead to a cure, which has, in one case, extended over five years. Heavy exposures in acute Hodgkin's disease are usually followed by rapid reduction in the size of the gland masses but with no corresponding improvement in the blood or in the patient's general condition. In these acute cases rest in bed, forced feeding, and mild fractional radiation are indicated. Burnham further states that the most unsatisfactory chronic cases are those with very little glandular enlargement but with marked constitutional symptoms and changes in the blood. In 2 or 3 cases of this kind which were met with, there has been but little amelioration of the patient's condition following treatment.

In every case in which the infection is limited to isolated groups of glands, such as one side of the neck and axilla, a complete disappearance of the glands can be looked for with confidence. When the disease is extensive, especially in mediastinal cases, this is more uncertain. As to technic, he states that treatment must be so planned that adequate radiation will be applied to all parts of the body affected by the disease. At the same time, great care must be taken to avoid injury of normal

structures, particularly the skin. It is probably desirable, even in early localized cases, to radiate all the regions of the body in which Hodgkin's disease is likely to appear. There is apparently no effect on gland masses when not directly radiated.

The guide to treatment is to be found in the effect on the gland masses, the blood, the appetite, and the general health of the individual case. No fixed plan of treatment is possible as a routine measure. The dose that is effectual in causing gland disappearance in 1 case may be many times greater than that required in another case. One patient may suffer with loss of appetite, fever, and general malaise from a treatment which when given another causes none of these disturbances. Several hundred milligrams is a workable minimum for use in the treatment of Hodgkin's disease. In a few cases as high as 50 gram hours in a single dose have been used.

Gamma radiation from radium placed at a distance from the surface varying from one and one-half to five inches, has been used—the length of the exposure being inversely proportional to the amount of radium employed.

Burnham's results are as follows: Excluding all patients in whom apparent cure has been less than three years, we have had, where lymphosarcoma was diagnosed, 2 cases perfectly well and without signs of trouble for more than five years; 1 an extensive neck case, and 1 an abdominal case. Four cases have been apparently well for over three years; 1 with pharyngeal and neck involvement, 1 with mediastinal, 1 with tonsil, neck and groin, and 1 case with neck and axilla involvement.

Excluding all patients in whom apparent cure has been less than three years, he has had, when Hodgkin's disease was diagnosed, one patient with mediastinal and neck involvement well for four years, and 2 cases well for more than three years. One of these had neck, axilla, groin and iliac glands; the other groin, axillary, neck and mediastinal involvement.

Tuberculous Lymphadenitis. In one of the Swedish Journals with an almost unpronounceable name, Wallgren⁸⁶ gives some interesting figures relative to the results at the Upsala clinic. They had had 526 cases and traced the history in 251. Of 79 with sound lungs at the time of the operation, 63 still are free from pulmonary disease, 9 have pulmonary tuberculosis; 5 had miliary tuberculosis and 2 tuberculous meningitis. Of the 29 with pulmonary tuberculosis at the time, 9 now have clinically sound lungs as also 3 of the 8 suspects. Of the total gland cases, 16.5 per cent. had pulmonary tuberculosis at the time. Of 224 traced cases, 3 per cent. had terminated with meningitis and 4 per cent. in miliary tuberculosis. On the whole, the pulmonary tuberculosis in these lymphoma cases seemed to be of a benign form. In 12 cases with a fatal outcome, the interval before death averaged five years; the range was from two to eleven years. Six of the patients were under sixteen and only three over thirty years of age. A number of writers have mentioned that in certain families some members develop pulmonary tuberculosis while others develop only tuberculous adenopathies and the lungs seem

⁸⁶ Abstract in Journal of the American Medical Association, 1918, v, 73.

to escape. Among 516 tuberculous persons given treatment at the chest clinic at Upsala, only 1.7 per cent. had a history of enlarged and probably tuberculosis glands before the onset of the pulmonary process. The general impression from the data presented, including a tabulation of statistics from various foreign clinics, is to the effect that the glandular disease augments the resisting powers, and determines a milder course if pulmonary lesions develop. In 1918, I abstracted a paper by Wang⁹⁶ who made the same statement as the above after an investigation among the tuberculous patients at the Seaview Hospital, Staten Island, N. Y.

Ligation of the External Carotid Artery. Nicholson⁹⁷ has written a paper upon the subject filled with practical points, some of which are quite at variance with accepted teaching. He states that the danger in his experience has been absolutely *nil*. He has tied the artery more than a hundred times. Four times, both external carotids were tied at the same operation; twice a common carotid at one side, and external upon the other; eight Dawbarn resections of the entire external carotid upon both sides, with an interval of a week between; and eighty-two single ligations, for the purpose of controlling hemorrhage. The indications given for ligation are as follows: (1) operations on the face and neck, making hemorrhage more controllable; (2) as a preliminary step in the removal of the upper and lower jaws; (3) in removal of the Gasserian ganglion (to this indication, to use the author's own words, I would "respectively disagree"); (4) in the removal of fibrous tumors from the back of the throat; (5) in removing the tongue and floor of the mouth, or the lips for cancer.

He makes his incision $1\frac{1}{2}$ inches long, with its center opposite the upper border of the thyroid cartilage; he states that he has not seen a sheath at the point of bifurcation but recognizes the artery by its position, bulbous appearance and yellowish white color. He ligates at the *immediate crotch* of the vessel, for thus no space is left in which a thrombus can form. He calls attention to the dense connective tissue, the remains of the carotid gland which binds the trunk together. At this point, the space between the vessels is simply an indistinct groove. The aneurism needle is passed from within outward, and when it comes against this tissue, it appears as if coming directly through the walls of the artery. He rubs the point through with the finger or some instrument, and threads it, and withdraws the ligature with it. This seems to work more satisfactorily than when it is threaded beforehand.

A practical point of extreme value is to have the anesthetist place his finger upon the temporal artery, and the operator either cross or pull upon the ligature, to see that it stops the circulation in the temporal.

The ligation should not be done with a grunt and a jerk, because Ballance and Edmonds, many years ago, demonstrated that a pressure of three pounds was sufficient to close the common carotid. Just enough force should be used to stop the circulation, and bring the inner walls of the vessel together.

⁹⁶ PROGRESSIVE MEDICINE, March, 1918, p. 71.

⁹⁷ Surgery, Gynecology and Obstetrics, 1919, vol. xxix, p. 77.

THE MAMMARY GLAND.

There has been a dearth of literature on this subject for some time, and I have seen nothing unusual or particularly new to report. MacCarthy and Conner⁹⁸ have published another paper on terminology and include some interesting figures upon the subject of diagnosis. The surgeons at the Mayo Clinic seem to have made a correct diagnosis as between malignancy or benignancy in about 83 per cent. of the cases (2100 in number); if specific in the diagnosis, as carcinoma, mastitis, etc., they were correct in about 94 per cent. of 836 cases. Thus, in nearly 60 per cent. the diagnosis was not specifically made before the specimen reached the laboratory. Perhaps this is due to the fact that "today each (clinician, surgeon, and pathologist) represents specialism in the field of medical science the many branches of which have grown to such proportions that no one individual can comprehend all clinical facts, perform efficiently all operations or master the subject of pathology completely. Each must know all of the facts upon his own subject and all must know enough of relationships to assist in the correlation of the knowledge of specialists."

His paper contains a list of an astonishing array of terms used by various writers in describing breast tumors—necessitating a solid page.

Deelman⁹⁹ reviews the outcome in 582 operative cases of mammary cancer at the Amsterdam public hospital from 1885 to 1915. Among the points thus brought out is that there is at least an 8 per cent. difference in the mortality between the figures for a three-year interval and a five-year interval. Only 30.6 per cent. were still living five years after the operation of the 245 patients operated on 1885–1911. Only one-third of the total operated on were living at the fourth year, and of those that had died in the interim five out of every six had succumbed to cancer or its consequences. A marked change for the better appears in the statistics from 1900 onward, and systematic postoperative raying seems to be improving conditions lately even more. Of the women operated on in 1900–1914, over 42 per cent. are still living. The figures show further that the age between forty and fifty offers the best chances for survival.

Operation for Breast Cancer under Local Anesthesia. Surgeons do not usually attempt such an extensive operation as amputation of the breast under local anesthesia. Labat,¹⁰⁰ offers no particular advantages for the use of local anesthesia except those incident to any operation under this method, namely, absence of postanesthetic troubles, shock, etc. His technic comprises four stages: (1) Intradermal infiltration; (2) blocking of the brachial plexus; (3) blocking of the intercostal nerves; and (4) subcutaneous infiltration of a wide field. The patient is given an injection of morphine and scopolamin, one-half hour before beginning the anesthesia. The most perfect asepsis must be maintained.

1. *Intradermal Infiltration.* By means of a very fine and sharp-pointed hypodermic needle the skin is injected at 8 points with novocaine

⁹⁸ Surgery, Gynecology and Obstetrics, 1919, vol. xxix, p. 44.

⁹⁹ Abstract in Journal of the American Medical Association, 1919, v, 73.

¹⁰⁰ Presse méd., 1919, vol. xxvii, p. 16.

(1 to 200). These points are as follows: At the acromioclavicular articulation; at the sternoclavicular articulation; at the base of the xiphoid process; at the level of the tenth costal cartilage; at the external limits of the operating field—the posterior angle of the axilla above, the junction of the vertical and horizontal lines below; two points between these limits.

2. *Blocking the Brachial Plexus.* This is the most difficult step of the procedure and the one in which failure is most likely to occur. Labat cautions that failure is the result of inexperience and not to the fault

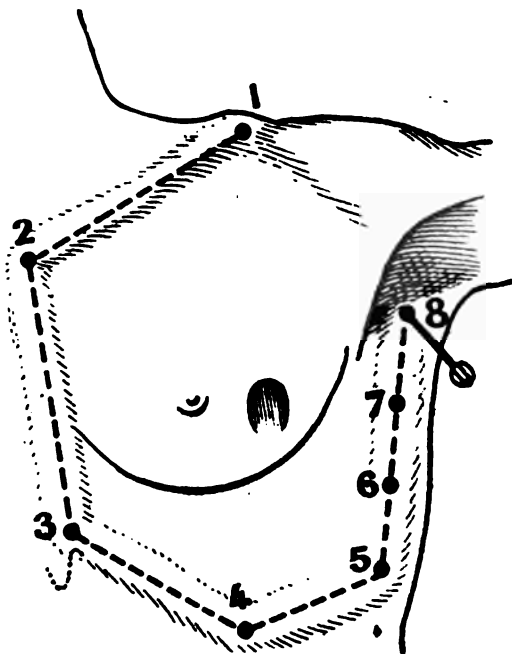


FIG. 44.—Superficial anesthetic barrage of the operating field. 1 to 8 represents the "dermal buttons" which are essential to avoid the pain caused by the insertion of a coarse needle: 1, acromioclavicular button; 2, sternoclavicular button; 3, xiphoid button; 4, button of the tenth costal cartilage; 5, 6, 7, buttons through which the needle skirts the intercostal nerves; 8, axillary button, radiating infiltration of the apex of the axilla. These points are united to each other by an injection made into the subcutaneous cellular tissue.

of the method. Anesthesia of the brachial plexus gives complete anesthesia of deep sensation and of muscle sense. The patient should lie at full length with the arms alongside of the body and the shoulders slightly depressed. The skin having been painted with iodine, a silver nitrate pencil should be used to make a mark at the middle of the clavicle. This point is the prolongation of the external jugular vein and corresponds to the position of the subclavian artery. The artery should then be accurately located with the index finger, its pulsations can be felt, but in order to be certain that these are not transmitted pulsations to the plexus, the index finger should glide from without inward to the

point where the pulsations cease; the finger is then drawn outward until the pulsations can once more be distinctly felt. Labat states that during this maneuver there is a sensation as if the pulp of the finger were traveling up an inclined plane just before reaching the culmination of the increasing intensity of the pulsations. He considers that at this point the palpating finger is exactly on the artery. At the level of the finger-nail, a dermal "button" should be made to anesthetize the skin. Then a needle at least 5 cm. long is plunged at this point gently downward and backward as if aiming at the spinous process of the second or third dorsal vertebra. If, at the distance of 15 or 20 mm., the superficial surface of the first rib has not been encountered, the needle should be withdrawn for a short distance and reinserted somewhat deeper in a slightly more oblique direction; the inexperienced operator is apt to err in passing the

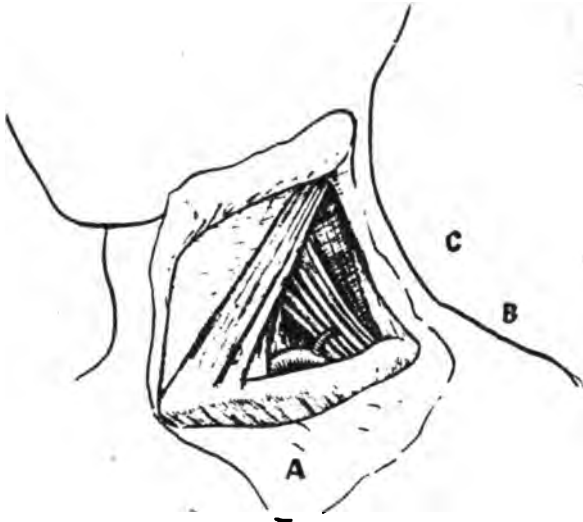


FIG. 45.—Anesthesia of the brachial plexus. This figure shows the relations of the artery with the plexus and the clavicle.

needle too superficially. There is no danger in making this point of localization. Externally, one would come against the apex of the axilla, and internally he would have to penetrate to a considerable depth to reach the pleural dome, puncture of which would be manifested by the escape of air, which need cause no alarm whatever; simply withdraw the needle; and do the same in case a vessel is inadvertently punctured.

After having reached the first rib without causing the patient any pain, we know that we have passed between the nerve trunks. Now slightly modify the direction of the needle until paresthesia is observed in the region of either the median or the radial nerve. It is rare, however, that one does not at once plunge into one of the trunks of the plexus. The patient experiences a pricking sensation or a sensation of engorgement (which is not sufficient); but more often there is pain, fulgurating or spasmodic, a characteristic proof that the needle is well-placed.

The syringe is attached and the injection of 10 c.c. of the 1 to 50 solution given. *Never inject the solution until the patient gives the signal of pain.*

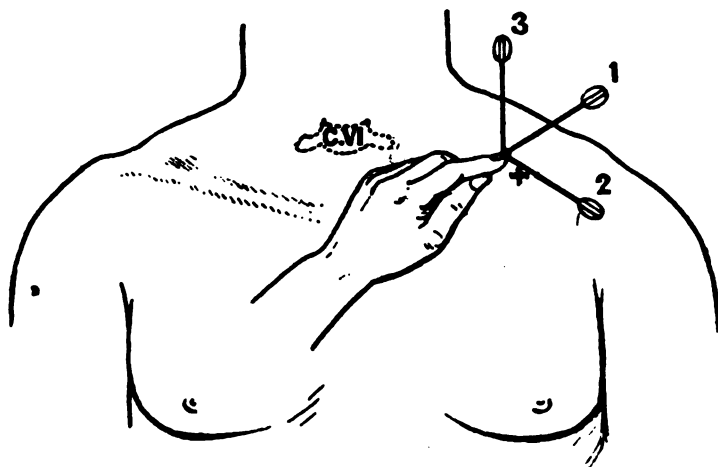


FIG. 46.—Anesthesia of the brachial plexus. The three directions of the needle for infiltration of the plexus. The tip of the index finger is on the apex of the artery and the needle penetrates along the margin of the finger-nail above, and in the middle of the clavicle: 1, the first stage, at which the patient indicates the exact moment at which one of the main trunks of the plexus has been reached; 2, the needle is directed downward on the clavicle and aimed for the tubercle of Chassaignac (C. VI); 3, the needle, almost vertical, is in the entire plexus on the external border of the first rib.

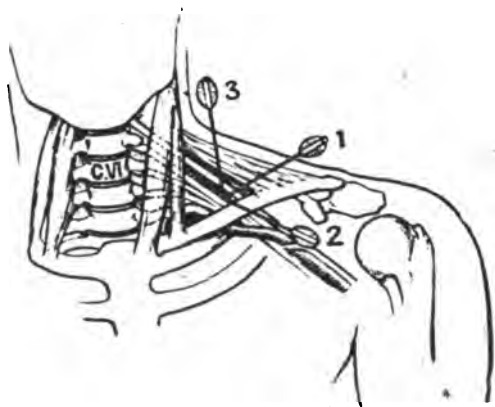


FIG. 47.—This figure represents the deepest plans, showing the needle in positions 1 and 3, infiltrating the plexus itself. In position 2 it bathes the main trunks anterior to the plexus.

The next step is to withdraw the needle for about 8 cm., depress the butt so as just to touch the clavicle and incline it obliquely upward and inward, as if aiming for the tubercle of Chassaignac, and then having plunged it to 15 mm., inject 5 c.c. of the same solution. Now again

locate the first rib, also as close as possible to the subclavian artery, and at the level of its external border, inject another 5 c.c. of the same solution. A weaker solution will give no results. The anesthesia will be complete in ten or fifteen minutes.

3. *Blocking of the Intercostals.* Labat injects the intercostal nerve under the ribs and does not attempt the so-called paravertebral method. He pushes his needle deeply under the inferior border of the rib and 5 mm. beyond the latter injects 2 c.c. of the 1 to 100 solution of novocaine. The first two or three intercostal nerves are not always accessible by this route, but the axilla can be indirectly infiltrated by an injection made in a radiating direction through the "button" at the posterior angle of the apex of the axilla. The anastomoses with the internal brachial cutaneous is reached by abducting the arm, locating the highest point of the axillary artery and protecting this artery with the finger, injecting the internal surface of the apex of the axilla with 20 c.c. of the 1 to 200 solution.

4. *Massive Subcutaneous Infiltration.* The operative field should be surrounded by an area of subcutaneous anesthesia limited (a) by the clavicle, above; (b) internally by the sternal border of the same side; (c) below by the thoracic border to the tenth costal cartilage and a horizontal line going backward from this point; (d) and externally, by a line beginning at the axillary cavity and descending to the horizontal line of the lower limit.

With a fine sharp pointed 9 to 10 cm. needle, enter the first dermal "button," inserting the needle for its entire length into the subcutaneous intracellular tissue, making it travel the length of the clavicle. Then fill the syringe with 10 c.c. of the novocaine-adrenalin $\frac{1}{100}$ solution, attach it and inject backward, *i. e.*, withdrawing the needle proportionately, 1 c.c. of the solution for each centimeter of the wall, then without raising the needle, let it glide along the acromion, and inject (as above) 3 c.c.

Withdraw the needle, puncture the sternoclavicular "button" to infiltrate the clavicular portion not reached; then, always without withdrawing the needle, go down along the sternal border, and so on to unite the other "buttons."

Fibrosarcoma. A rare example of mammary tumor has been reported by Graves.¹⁰¹ The patient was thirty years of age and the tumor noticeable for fifteen years, but had been small until the birth of a baby about eight months before, after which it grew rapidly. There was no pain, but it gave considerable discomfort because of its size and weight. The pathologic description was as follows:

"Specimen consists of an irregular, nodular mass 15 x 17 x 21 cm., covered with skin on one side and fascia on the other. In skin appears nipple of mammary gland at one edge. At opposite end is a brown scab 10 x 12 cm. over a fluctuating area 7 cm. in diameter. Some bosses are very hard, others are soft and fluctuating. On section a large amount of thin, chalky fluid escapes. Cut surface presents numerous lobulated,

¹⁰¹ Kentucky Medical Journal, 1919, xvii, 329.

firm masses rounded in outline and varying from 1 to 15 cm. in greatest diameter. Some of these appear grayish with interlacing, pearly white lines between which tissue is tinted from pinkish brown to pale amber. Diffuse, scattered red spots. Some lobules are tough and flabby, streaked and mottled with yellow or creamy surface and readily fall away from fibrous tissue septum. From these recesses thin creamy gray fluid can be expressed. In one place a pocket of thick, creamy fluid is opened and about 25 c.c. escapes. On multiple sections a few smaller lobulations are found, circumscribed and surrounded with fibrous tissue which is pinkish brown and homogeneous."

Microscopic section showed a pure, rapidly growing, connective-tissue tumor—a malignant fibroblastoma or fibrosarcoma.

SURGERY OF THE THORAX, EXCLUDING DISEASES OF THE BREAST.

By GEORGE P. MÜLLER, M.D.

SURGERY OF THE HEART.

Heart Massage. There is apparently a revival of interest in this method of treatment. In 1908, the paper by Green¹ was abstracted in which he reported a collection of 40 cases, of which 9 were entirely successful, 8 partially so, and in 12 the circulation and respiration were restored, but death ultimately ensued. Earlier than this considerable attention was excited and the cases were duly chronicled in these columns. Last year I collected a number of cases, among them the interesting report by Bost. This writer has practically duplicated his paper in a second published recently.

Harries² reports a case in which the patient collapsed while under chloroform anesthesia. Through an abdominal incision, Harries submitted the heart to a series of rapid squeezes between the two hands at the rate of about 50 to 60 a minute. After the tenth compression the heart started beating. It went on for thirty beats, at the rate of 90 to 100 a minute, and then stopped. The squeezing was repeated, and after the fourth compression the heart again started beating—at first very irregularly, and stopping at intervals for two to three seconds. After about ten minutes of this irregularity, the heart beats and pulse started alternating, and the alternation continued until the onset of the final collapse preceding the patient's death sixteen hours later. During these procedures, Harries was impressed by the fact that the heart could not be felt through the diaphragm when it was not beating; but as soon as it commenced to beat, the cardiac impulse was much more distinctly felt than the apex beat on the chest wall.

Another case is reported by Petty³ in which the cardiac failure followed the administration of chloroform, ether and oxygen. When the incision was begun it was noted that no blood oozed from the wound, and the anesthetist stated that the patient had ceased to breathe. No pulse and no cardiac sounds could be detected. Artificial respiration and stimulants were without avail, and ten minutes later the abdomen was opened and massage begun. In thirty seconds violent cardiac contractions occurred, but a second cardiac syncope occurred; massage was again successful in one minute. The man ultimately recovered, but was unconscious and then violent for many hours.

¹ PROGRESSIVE MEDICINE, March, 1908, p. 131.

² Indian Med. Gaz., 1919, liv, 53.

³ Lancet, 1919, ii, 784.

Norbury⁴ states that he has had occasion to practise heart massage in 14 to 16 cases with a successful result in 3, not including several cases of temporary stoppage in which the abdominal cavity was already open, and immediate massage quickly restored pulsation. Norbury sums up our knowledge of this method as follows:

1. In cardiac massage we have a very important adjunct to the methods of resuscitation, applicable in cases of heart failure during surgical operations, as also in certain other conditions already mentioned. With stoppage of the heart during the performance of an abdominal operation, no time should be lost before starting subdiaphragmatic massage, and valuable time should not be wasted in the administration of drugs. Artificial respiration and cardiac massage should be carried out simultaneously. In such circumstances, a very few compressions will usually reestablish the heart beat.

2. If heart massage be contemplated, it should be commenced certainly within five minutes of cardiac arrest. I should personally be inclined to resort to massage after giving other methods a trial of only two minutes.

3. It may be necessary to continue rhythmical compression of the heart for several minutes before spontaneous contractions occur.

4. The subdiaphragmatic route is undoubtedly the most satisfactory of the various methods of access to the heart for purposes of massage.

5. Artificial respiration should be commenced as soon as normal breathing has ceased, and should be persevered with until spontaneous breathing is reestablished; as has been previously shown, it may be necessary to continue artificial respiration for some minutes after the heart beat has been restored.

6. In obstinate cases means should be adopted for raising the blood-pressure, either by pressure on the abdominal aorta, bandaging the extremities, or the application of Crile's pneumatic suit, if this be at hand. Intravenous infusion of weak solutions of adrenalin in normal saline is also very efficacious, and this will be especially applicable in cases in which intravenous infusion with saline has already been started before the heart stopped, when adrenalin can be quickly added to the solution. In cases in which an intravenous infusion is not being already carried out, this may be done quickly by using the internal saphenous vein, since the arms will be wanted for performing artificial respiration, or, as an alternative, the common carotid artery may be exposed in the neck, and a weak solution of adrenalin in normal saline solution be forcibly injected toward the heart by means of a syringe with a fine needle attached.

7. Injection of adrenalin solution into the heart cavities or wall is liable to set up fibrillary twitchings, and is of no use as a means of restoring normal cardiac contractions.

8. Never give up a case of apparent death under an anesthetic as hopeless until cardiac massage and its various accessories have been given a fair trial.

⁴ *Lancet*, 1919, ii, 601.

It will be noted that Norbury prefers the subdiaphragmatic route, and this seems to be the consensus of opinion of most writers on the subject. Timidity should have no place when confronted with this emergency. Reference to the paper by Bost and Neave, abstracted last year, will show that he goes further and urges, should the heart remain unresponsive, incision of the diaphragm, after which the hand is pushed into the thoracic cavity anterior to the pericardium and the base of the heart massaged, since little air can enter the chest by the technic suggested, and in view of the fact that pneumothorax has been shown by war-time experience not to be as serious as it was formerly considered, perhaps even this direct massage should become a routine measure when all else has unavailed.

It is clear, from a study of the reported cases, that chloroform seems to be the anesthetic usually given, and this only adds weight to the current opinion that it is not a safe drug for anesthesia under ordinary circumstances.

In connection with massage of the heart for cardiac failure, the unusual case reported by Zuntz⁵ should be presented. A woman, aged fifty-six years, feeble and emaciated, had had a resection of the cecum and ascending colon for carcinoma. When the intestines were returned to the abdominal cavity, the patient collapsed, and no trace of a pulse could be felt. Artificial respiration and subcutaneous injection of camphor were of no avail. After four or five minutes, during which heart massage was tried (by what method is not stated), intracardial injection was performed as a last resource, a puncture with a long needle was made three finger breadths to the left of the sternal edge in the fourth intercostal space, the point of the needle being directed toward the mid-line. One cubic centimeter of adrenalin was now injected. In half a minute the carotids could be seen beating again and spontaneous respiration was resumed. Surprise may be felt that the needle entered the right ventricle and not the left, but the obliquity of the heart is such that but little of the left ventricle presents, and it is not easy to inject unless dilated. Zuntz was uncertain as to whether the injection was made into the musculature of the right ventricle, or whether into the ventricular cavity.

THE LUNGS AND PLEURA.

Wounds. With but few exceptions, the discussion of war wounds of the chest in these columns has been based on the observations of British and French surgeons. During 1918, the operations of the American Army enabled the surgeons from the United States to profit by the experience of their confrères from the allied armies and to add certain observations of their own.

A report from the Central Medical Department Laboratory, A. E. F., signed by Yates, Middleton, Drane, and Gwathmey,⁶ is a model contribution. It is based on experimental research and clinical service in the

⁵ München. med. Wchnschr., May 23, 1919.

⁶ Boston Med. and Surg. Jour., 1919, clxxx, 405.

forward areas. David and Miller,⁷ Blankenhorn,⁸ Lebowitz and Nadler,⁹ Eliot,¹⁰ Lilienthal, Brickner and Kellogg,¹¹ McGuire,¹² LeConte¹³ and Green¹⁴ have published the results of their experiences in the American Army.

Their works follow along the lines laid down so ably by Duval, Gregoire, LeFort, Villeon, Gask, Lockwood, Nixon, Turner, Bastianelli, and others, who laid the foundation for one of the most brilliant chapters of the surgical accomplishments in the War.

It is not necessary now to go over the ground covered in these pages during the past few years. The indications for operation are well-known and were summarized by the Inter-allied conferences, and in the paper by Lockwood and Nixon.¹⁵ Further information may be obtained from the recent paper of Nixon,¹⁶ and in the Symposium before the British Medical Association by Elliott and Gask,¹⁷ and that before the Clinical Congress in 1918 in which Duval, Bastinelli, Gask and Turner participated. Gregoire's excellent book is now available in the Military Medical Manual Series.

I do not intend to devote much space to the war surgery this year, being content with presenting abstracts of papers describing certain phases which seem, to me, of importance. In the report by Yates, mentioned above, he found time in the midst of the activities of the A. E. F., to work upon a practical problem with almost the same ease as in a laboratory at home. This problem consisted of the following factors:

1. Parietal repair. Primary healing must be assured.
2. Limitation of pleurisy. Reduction in intensity, extent, and duration.

(a) Elimination of pleural irritation; (b) determinate factors in pleural resistance; (c) lung repair, preserving its elasticity; (d) reinflation of lung, reestablishment of intrathoracic negative pressure; (e) immobilization of the affected side of chest; (f) drainage, with conservation of normal negative pressure.

3. Anesthesia. Administration of nitrous oxide and of oxygen so as to control intrapulmonary pressure.

We will not discuss all of these. One of the most interesting was that on the determinate factors in pleural resistance.

PLEURAL RESISTANCE. Yates believes that the three conditions precedent to smooth healing, elimination of irritation, physiological rest and increased blood supply are equally effective in promoting intrapleural resistance. It is because of the interdependence of circulatory and respiratory functions upon pleural integrity that its preservation

⁷ Surgery, Gynecology and Obstetrics, 1919, xxix, 435.

⁸ Journal of the American Medical Association, 1919, lxxiii, 251.

⁹ Surgery, Gynecology and Obstetrics, 1919, xxix, 429.

¹⁰ Annals of Surgery, 1919, lxx, 30.

¹¹ Jour. American Medical Association, 1919, lxxii, 839.

¹² Journal of the American Medical Association, 1919, lxxii, 1269.

¹³ Annals of Surgery, 1919, lxx, 37.

¹⁴ Journal of American Medical Association, 1919, lxxii, 1336.

¹⁵ PROGRESSIVE MEDICINE, March, 1919, p. 120, etc.

¹⁶ British Medical Journal, 1919, i, 399.

¹⁷ Ibid., 442.

assumes such great significance. The point in his experimental observations on the inhibition of costodiaphragmatic movements that interested me most was the observation that the series in which the phrenic was injected showed a remarkable freedom from distress and a reduction in the amount of postoperative pleural effusion. Still more significant was their general condition on the fourth or fifth day, when the diaphragm resumed its function. This stage of convalescence corresponded to the tenth to fourteenth day in those animals subjected to identical operations, but in which no phrenic injection was made.

He concludes that: "in order that the three cardinal conditions upon which healing depends may be established after thoracotomy, the following precautions must be observed: Reduction in irritation by the least mechanical trauma; protection of the serosa against exposure and drying; preservation of lung elasticity; accurate pleural approximation; the establishment and maintenance of normal negative intrapleural pressure; and the restriction of respiratory function for the first few days."

ANESTHESIA. The use of inhalation anesthesia, and particularly ether or chloroform, is a factor adding considerably to the risk in lung surgery. Duval advises local or regional anesthesia, stating that the patches of pulmonary congestion, which so frequently occur after operation, may be in some measure attributed to the effects of inhalation anesthesia, as well as to the after-effects of the wound of the lung. He has attempted spinal anesthesia, but the results have not been sufficiently uniform.

Lockwood and Nixon also used local anesthesia reinforced by gas-oxygen while the hand is inside the chest or if the patient is restless. On the other hand, Gask prefers chloroform, either by itself or combined with oxygen.

Yates found that a safe sequence in practice was found to be as follows: After the effect of the pre-operative hypodermic of morphine was present, administrations of pure oxygen under no tension were started. Then very gradually the pressure was increased, and the administration of nitrous oxide started. Rapidity of induction of the anesthesia was undesirable. Avoidance of excitation and the producing of gradually increasing inflation were essential. During the operation the proportions of the gas-oxygen mixture and the pressure transmitted to the trachea were varied to meet conditions. After the parietal pleura was closed the amount of nitrous oxide was gradually reduced; last of all, oxygen under pressure was continued until the patient was conscious.

The American Red Cross nitrous oxide apparatus perfected by Captain Gwathmey and adopted by the Army, fulfilled every requirement. This apparatus provides a mask that can be rendered relatively air-tight by close approximation to the face, an escape valve, a mixing bag close to the inhaler and a rough gauge for estimating the proportion of the gases.

Intrapulmonary pressure was raised by increasing the rapidity of the flow of gases from the tanks, and by increasing the pressure upon the face-piece. It was lowered by decreasing the rate of flow of the gases

or by releasing the valve or decreasing the pressure which held the face-piece in place. Thus, any degree of desirable inflation or deflation was promptly available to meet operative requirements. In general, the degree of pressure utilized was that best suited to the animal or man under operation.

This method gives all practical requirements for intrathoracic surgery without necessitating deep anesthesia for the introduction of intra-tracheal or endopharyngeal tubes. Moreover, its safety and ease of control has removed the chief obstacle to a wider application of surgical therapy.

CLOSURE OF THE CHEST OPENING. One of the problems of chest surgery is the difficulty of suturing the pleura so as to hermetically seal the opening. Duval sutures the intercostal muscles and pleura, together; Moynihan, in his well-known paper, advises wide separation of the pleura from the ribs in all directions (thus mobilizing it) before opening the cavity. I have not found this to be a very satisfactory procedure, however, in several cases. The reason lies in the persistence of the rib separation at the conclusion of operation. A number of surgeons overcome this separation by passing silver or bronze sutures around the ribs above and below the incision and tying with sufficient tension. Duval mentions particularly the importance of covering the resected ends of the rib with a staunch muscle suture because of the difficulty in bringing the pleura together here.

The muscles and fascia should be covered layer by layer with intercepted sutures.

OPEN PNEUMOTHORAX. In one of the most interesting and important papers published for some time Graham and Bell¹⁸ report their experimental results on open pneumothorax in normal and diseased chests, etc. By a mathematical calculation of all the factors entering into the phenomenon of respiration, they conclude that a normal human adult should be capable of withstanding for a short time an opening of about 51.5 sq. cm. (5 x 10 cm. or 2 x 4.1 inches). They conclude that "The prevalent conceptions of pneumothorax are erroneous in that they are based on the assumption that when an opening is made into the chest one lung is collapsed and the other maintains respiration. This assumption implies that the mediastinum constitutes a rigid partition between the two pleural cavities. On the contrary, the mediastinum is so mobile that any increase of pressure in one pleural cavity pushes it over into the opposite one so that both lungs are compressed practically equally. No such condition is possible, therefore, of collapse of one lung and maintenance of respiration with the other in a chest with a normal mediastinum."

The importance of these conclusions, according to Graham and Bell, rests on the statement of Moynihan, that the free admission of air "as a rule, causes no disturbance and does not alter the rate of the respirations or of the pulse." Graham believes that a study of the writings of Duval, Piéry, Gask, and others, show the converse to be true. Now

¹⁸ American Journal of the Medical Sciences, 1918, clvi, 839.

while no doubt Moynihan in the enthusiasm of the time exaggerated the simplicity of a wide open operation on the chest, Graham does not take into account the actual happenings at the operating table. The skilful surgeon works swiftly and one movement succeeds another. The opening made in the chest is larger than that set as the limit of safety by Graham but as the opening is made, the lung is grasped and *held*, while the foreign body is searched for and removed, and *held* out of the way while the cavity is mopped. When the lung is dropped, we are so accustomed to the use of a moist pad while suturing that no mention is made of its presence. These procedures more than equalize the excess in the size of the opening and prevent the mediastinal bowing to a great extent. I do think that we are probably in for some unnecessary deaths the result of overenthusiastic surgery by the younger men and hence the caution given by Graham and Bell is timely.

ARTIFICIAL PNEUMOTHORAX IN THE TREATMENT OF CHEST WOUNDS. This procedure attracted some attention in the earlier years of the war, and certain writers advocated oxygen replacement to relieve the tight feeling experienced during aspiration. The production of pneumothorax to prevent continued bleeding was also brought forward, but I do not think that anyone advocated its systematic use. This has been done by Bastinelli.¹⁹ He states that after the primary hemorrhage, which may be small or large, the bleeding frequently continues because the pressure in the pleural cavity is negative, the lung continues to expand, and because of these continuous movements and of the suction induced by the negative pressure at each inspiration, the vessels are kept open and the blood sucked out, until they are closed either by thrombosis, or by the closure of the wound, or by collapse of the lung induced by the hemo- and pneumothorax.

If no untoward complication arises, the air is first absorbed, and then the blood, and a cure results, either complete without functional impairment, or incomplete, with functional consequences of great importance. He calls attention to the important point that a fluid collection (blood) does not induce complete lung collapse and immobility. Every time the chest expands the liquid cannot follow it, not be compressed during expiration; so that the lung, unless totally collapsed, must follow the chest movements. The lung in such condition of incomplete expansion will remain for days and weeks facing points and surfaces of the parietal pleura not corresponding anatomically to the point and surfaces of the lung when expanded. Adhesions occurring in these conditions, when firm and old will not allow a complete pulmonary expansion but only of limited zones; hence there results incomplete pulmonary function, displacement of the diaphragm and mediastinum, and permanent damage to the lung. Besides, the blood is frequently absorbed slowly, fibrinous deposits are formed, and the complementary spaces obliterated. Sometimes a blood collection remains encysted, and there is a continuous source of pleural irritation with effusion of pleuritis liquid, and not rarely a reason for infectious complications. On the other hand, air in the

¹⁹ Surgery, Gynecology and Obstetrics, 1919, xxviii, 1.

pleural cavity means that the lung is completely surrounded by it; hence, contact with the parietal pleura is impossible, and there are no adhesions in abnormal zones of the retracted lung. And, when it does expand later, even if through inflammatory conditions of the parietal pleura, adhesions occur, these are on the surface of the totally expanded lung, so that the function is perfect even if a complete pleural symphysis occurs. Besides, a compression produced by a gas is an elastic one, consequently it can follow the chest expansions, because the gas is easily rarefied and compressed.

The presence of air in the chest is then to be considered the most favorable condition for the cure of lung wounds, and we have only to follow and imitate nature in treating them. That means, remove the blood which is dangerous, and put in its place air which is favorable. From these considerations we arrive at the practical part of Bastinelli's article, *viz.*, the production of an artificial pneumothorax in chest wounds. We need not abstract Bastianelli's discussion relative to the difference in procedure in closed or open wounds. The latter will rarely be seen again until the next war. It suffices to say that he advocates air-tight closure of the parietal wounds, evacuation of the blood and the introduction of air. If a pneumothorax is demonstrable without noticeable hemothorax, we should test its pressure, and if it is too high and producing functional disturbances, the pressure should be diminished. Abundant hemothorax requires withdrawal of the blood and introduction of air so as to increase the pleural pressure to a positive one. But if with large blood collection there is spontaneous pneumothorax under high pressure, this means that a high pressure has to be maintained to keep the hemorrhage in check, and we have the indication for the withdrawal of blood and the introduction of as much air as is necessary to keep the pressure at the same height. The air is introduced by means of an apparatus devised by Morelli but is similar to those familiar to us all in use in the production of pneumothorax in lung tuberculosis. Of 206 "closed" cases there were 88 treated by pneumothorax, and 118 treated by thoracentesis and pneumothorax, with a mortality of 7, or 3.4 per cent. Of these, 3 were due to empyema, 1 to pulmonary abscess, 3 to septicemia. Of 76 "open cases," 11 (14.4 per cent.) died, of which 7 were due to empyema and 4 to septicemia. It is interesting to compare Duval's attitude regarding air in the chest. He states that "from every point of view, the aspiration of the intrapleural air is an excellent procedure." "As is proved by daily x-ray examination, spontaneous absorption of the pneumothorax is not completely effected for several days, and during this period the function of the lung is diminished. Now it must not be forgotten that one of the causes of congestion in the sound lung is the extra work thrown upon it."

LATE EXTRACTION OF INTRATHORACIC PROJECTILES. In 1918, I²⁰ referred to the method of Petit de la Villeon whereby projectiles could be removed through minute incisions by means of special forceps of the alligator type. Except in the French literature, this method has been

²⁰ PROGRESSIVE MEDICINE, March, 1918, p. 114.

rarely referred to. At the meeting of the American Surgical Association in 1919, LeConte²¹ describes the method and highly praises its efficacy. He was able to observe the operation personally at l'Hôpital de la Marine de Brest. He also states that during the meeting of the Congress of French Surgeons held in October, 1919, Petit de la Villeon reported about 330, and Robin 92 extractions of foreign bodies from the chest. There were 4 deaths in these combined series, a mortality of a little less than 1 per cent.

Robin²² describes the technic of this method, not only for foreign bodies in the lung but also for those elsewhere. He states that in the soft parts it may be undertaken with safety by any surgeon knowing anatomy. By a slight modification of technic even foreign bodies in the brain may be removed after craniotomy and opening of the meninges.

He uses the table of le Coniac which consists essentially of a plane revolving around its long axis. The patient is firmly fastened to the rotatory table, so that he may be turned from right to left and inversely around its axis without falling.

Localization is made, not by compasses nor apparatus, but by a knowledge of the anatomy of the region—the respective displacements of the foreign body on the one part and of the organs of the neighborhood, chiefly bones, while the body is being rotated from one side to the other.

The shadow of a foreign body situated in front of the general axis of rotation will displace in the same direction as the part of the body which is next to the screen and in an inverse direction than the part of the body nearer the screen. If the foreign body is behind the axis, the contrary will take place. Besides, it is evident that the displacement of the shadow is more rapid when the foreign body is more distant from the axis of rotation.

During the rotation the shadows of the skeleton move also. The relative displacement of the shadow of a bone and the image of the foreign body is considerable when they are widely separated; if, during the rotation, bone and foreign bodies keep at the same distance and move in the same direction, one may say that they are near each other. The displacements of the foreign body during spontaneous, induced, or physiologic movements give very useful information. As an example, we may suppose the piece of a shell in the fleshy part of the limb; if the radiologist moves it through the skin, these movements may be seen on the screen, and the propulsion will reach its maximum when the fingers are as near as possible to the foreign body.

The shadow of a bullet in the scapular region will displace on the ribs during the raising up of the arm, and this simple test will show that it is not intrathoracic. Hence, if an intrathoracic foreign body follows exactly the movements of the diaphragm, but at a distance from it, one can be sure that it is intrapulmonary. If, on the contrary, it goes up and down with the ribs, it is depending on the ribs. Then we use the method of rotation to find out if it is extra- or intrathoracic; in the latter case, it is either pleural or cortico-pleural with pleural adhesions.

²¹ *Annals of Surgery*, 1919, lxx, 37.

²² *U. S. Naval Medical Bulletin*, 1919, xiii, 237.

The projectiles on the dome of the diaphragm are localized without difficulty, but where the shadow of the foreign body is continuous with the shadow of the diaphragm, the question of anatomical localization is difficult, for it may be imbedded in the diaphragm, or sub- or supra-diaphragmatic. Sometimes its exact localization cannot be determined without an exploratory operation, either by the abdominal or thoracic routes.

When the shadow is in the quadrilateral space bounded by the internal borders of the scapulæ and the fourth to the eighth ribs, its anatomical position with regard to the great vessels and large bronchi at the root of the lung is most important. On a lateral view the hilum of the lung will be between the plane made by the anterior portion of the bodies of the vertebræ and the posterior shadow of the plane of the heart. If the shadow of the foreign body lies posterior or anterior to this space, the projectile is imbedded in the lung at a safe distance from the hilum, and may be readily extracted without danger, no matter what its depth may be from the costal margin. Above the fourth rib and below the eighth rib it is also in an easily accessible region. Extractions from the hilum of the lung will be discussed in a later paragraph.

In the left chest the relations of the "eclat" (shell fragment) to the pericardium and heart must be exactly determined, and if it moves with the heart beats and fails to move with respiration, extraction by means of the fluoroscope should not be attempted, and an open operation is indicated.

Robin states that the patient is always anesthetized when the lights are on and should never be administered in the dark except by a skilled anesthetist. I have had one disagreeable experience of this kind while attempting the removal of a foreign body from the foot in the dark room. The patient was under gas-oxygen anesthesia and came within a hair's breadth of dying.

A buttonhole incision is made and the introduction of the forceps begun. By rotary movements of the table the progression of the forceps to the foreign body is made in one-half inch steps. By watching the tip of the forceps it will be noted that when they and the foreign body are in the same vertical line, if the table be made to rotate, that shadow which moves more rapidly in the direction of the rotation is the more superficial. By one or two rotary movements the surgeon ascertains whether his forceps is too superficial (between the foreign body and the skin) or too deep (between the foreign body and the table).

The method is highly interesting and the technic is simple enough, but, as LeConte says, it is highly specialized and requires: (1) The radiosopic eye, (2) the intuitive correlation of the two shadows made by the foreign body and the point of the forceps, and (3) gentleness and dexterity of hand.

As a contraindication, Robin only mentions the region of the hilum of the lung. LeConte states that an open operation is to be preferred when projections are to be removed from the mediastinum, pericardium, heart, the medial region of the diaphragm, and the left diaphragm, unless

the missile is clearly diaphragmatic. LeFort²³ advises this method for the removal of small and medium-sized projectiles in the pulmonary parenchyma at a distance from the region of the hilus and mediastinum. He states that the procedure is difficult and even after some practice often required prolonged groping. But, he states, the results are excellent and the immediate and permanent sequelæ are extraordinarily free from complication.

LeFort prefers Marion's procedure for the removal of large, irregular shell splinters situated in the superficial layers of the lung. All projectiles of the dangerous regions of the mediastinum, all those of the hilus, the pericardium, and the pulmonary ligament must be operated on through a wide avenue of approach.



FIG. 48.—Costal flap involving the third, fourth, fifth and sixth ribs; drawn by M. Macquet from nature during operation.

LeFort advocates Duval's method and believes that the anterior or anterolateral route is immeasurably superior to the posterior route. Almost the entire mediastinum is in the anterior half of the thorax, and the anterolateral wall is thin and flexible, whereas the posterior wall is thick and rigid. Duval's method was minutely described in these pages in 1919.²⁴ Le Fort, however, while recommending the method of Duval, adopts the technic of Delorme as improved on by himself (Fig. 48). The flap is cut widely and regularly by dividing the costal cartilages and the intercostal spaces at equal distance from the bordering ribs (so as to permit the repair of the wall); it is then raised, guarding against fracture of the ribs either by simple elevation, if the flap can be extended very far outward, as is the case with the lower ribs, or by causing a greenstick fracture through strong but cautious pressure, as can be done in

²³ Medical Record, 1919, xcvi, 190.

²⁴ PROGRESSIVE MEDICINE, March, 1919.

the majority of youthful individuals, up to and even above thirty years of age. This procedure provides the most light, permitting complete exploration of the entire thoracic cavity, from the clavicles as far as the diaphragm, and from the sternum to the vertebral column and ribs behind. It facilitates all manipulations, the introduction of both hands and instruments into the interior of the thorax, and the direct inspection of the entire cavity.

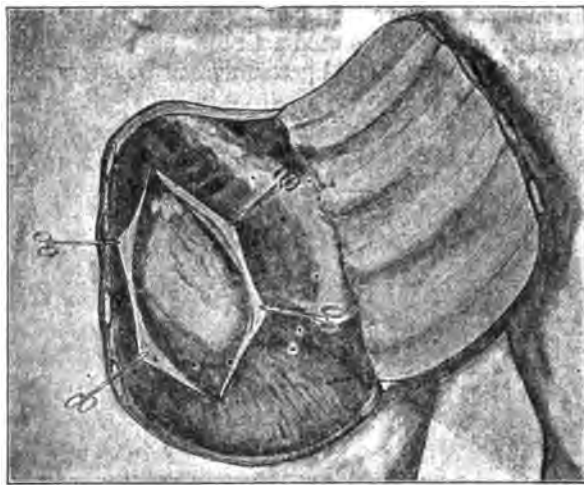


FIG. 49.—A venue of access to the heart, the large bloodvessels, and the pericardial cavity by the costal flap with external hinge, and incision of the pericardium in front of the left phrenic nerve. (*Revue de Chirurgie*, 1917.)

LeFort states that in one instance by means of the anterior incision he was able to obtain hemostasis of the wounded vein behind the diaphragm.

Another method which LeFort apparently favors even more than the Delorme flap is the following: A simple incision of one intercostal space permits separating the ribs by about 6 cm.; division of the cartilage above or below permits of a separation of 8 cm.; division of both cartilages together gives an opening of about 10 cm.; and the supplementary division of another cartilage enables one to enlarge the separation to 12 cm. It is very advantageous always to make the incision in an intercostal space situated slightly below the level of the foreign body which is to be extracted. This way of proceeding involves a twofold advantage; on the one hand the avenue of access supplied by the incision of an intercostal cartilage is so much the larger, the lower the intercostal space; the costal cartilages above can be very easily transformed into a costal flap by simple section of a higher intercostal space.

In certain special cases Le Fort has adopted other procedures of which the following two may be described:

1. *The Sternocleidocostal Flap.* This operation provides free access to the cervicomediastinal "crossroads" to the arch of the

aorta, the origin of the carotids, the brachiocephalic trunks and the subclavian veins, the internal portion of the apex of the lung, and the entire half of the superior mediastinum without sacrificing the clavicles, without opening the sternocostoclavicular articulations, without damaging any organ, any vessel, nerve, or important muscle. It consists

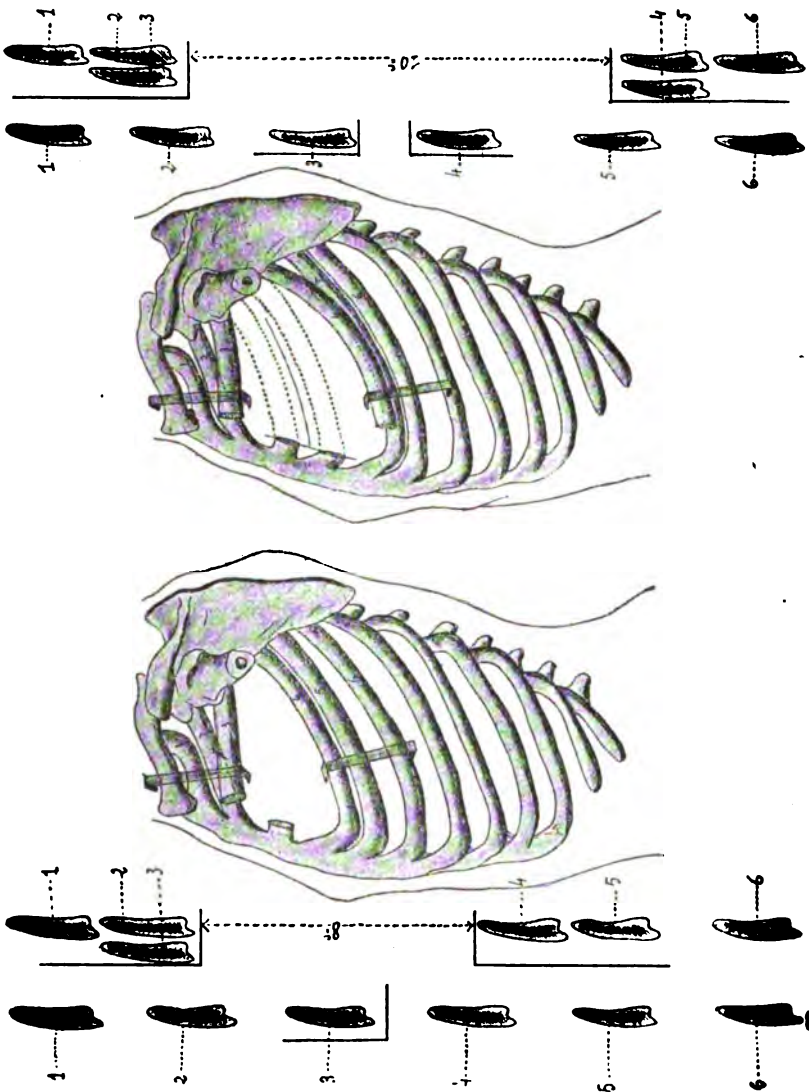


Fig. 50.—On the left, incision of the third intercostal space with division of the third costal cartilage, showing the result obtained by maximum separation of the ribs. Sectional and frontal view. On the right, the same with the addition of a division of the fourth costal cartilage. The two figures show the ribs, whose cartilages have been divided, overriding the neighboring ribs. (LeFort. *Revue de Chirurgie*, 1917.)

in turning upward and outward a flap which comprises the clavicle, the first rib, and the upper outer segment of the sternal manubrium where these bones are inserted.

2. *Median incision* of the sternum, the pericardium, and the diaphragm, or Duval's method, provides free access to the heart, and is

recommended for certain operations upon the right heart. Sometimes it may be desirable to add to the flap with an external hinge, a small sternal flap with an internal hinge, etc.

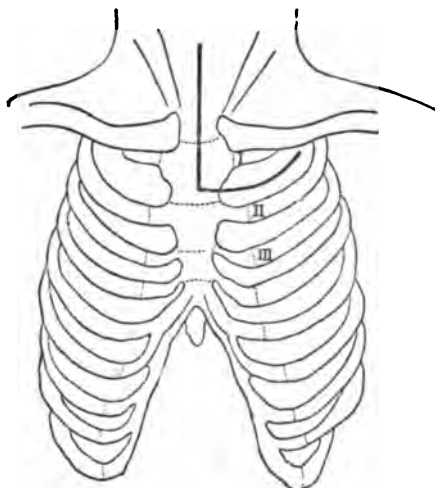


FIG. 51.—Line of incision for the sternocleidocostal flap. Le Fort. (*Presse Méd.*, 1918.)

Le Fort's description of the appearance of certain organs in the chest is so graphic that it is here reproduced:

"The aorta conveys to the finger the feel of a bicycle tire. The pulmonary artery is strong and resistant. The phrenic and the pneumogastric nerves are easily recognized; the trachea and the large bronchi are plainly perceptible to the finger. The lung is soft, and can be displaced in all directions without inconvenience. The heart is a viscus whose hardness and strength are truly remarkable. One can move it about and raise it without fear. Pressure on the ventricles accelerates its action, while pressure on the auricles slows it. The cardiac walls may be pricked, pinched, or incised without a very prolonged modification of the rhythm; the auricles may be pinched or pulled, but compression of the communicating canal of the auricle and auricular appendage causes instantaneous arrest of the heart. In a general way, all manipulations may be cautiously attempted. When arrest or grave changes in the rhythm of the heart supervene, they cease almost immediately after the manipulation which has caused them.

X-RAY SIGNS IN GUNSHOT WOUNDS OF THE CHEST. The value of this method of diagnosis is unquestioned. Last year I abstracted fully from the recent book by Barjon, a mine of information for surgeons concerned in the treatment of chest injuries and disease. One of the best summaries of the *x-ray* signs that I seen is that by Crymble.²⁵ The association of *x-ray* appearance and physical signs is particularly valuable. He notes the following:

²⁵ *Archives of Radiology and Electrotherapy*, 1919, xxiii, 346. Also *British Journal of Surgery*, 1918, v, 363.

HEMOTHORAX. Diaphragm high and immobile. Heart displaced to sound side. An opacity of the lung area, which, in the sitting position, occupies the whole area or leaves a variable amount of the upper region clear. Upper margin of the opacity irregular.

Percussion. Posterior. Dulness up to the inferior angle or spine of the scapula. Anterior. Skodaic resonance (lower pitched and tympanitic).

Auscultation. Posterior. Breath sounds weak or absent; in 5 cases tubular breathing changing to weak or absent breath sounds; in 9 cases tubular breathing. Anterior. Weak breath sounds.

TRAUMATIC INFARCT. Opacity in region of lung wound. In some cases fragments of bone or metal in the center of the opacity. Posture has no effect on the opacity. Diaphragm immobile or acting.

Percussion. Normal, or dulness over infarct.

Auscultation. Weak breath sounds over infarct; tubular breathing in 1 case; adventitious sounds in 2 cases.

HEMOPNEUMOTHORAX (Sitting Position). Diaphragm high and immobile. Heart displaced to sound side. Opacity of lung area, surmounted by a clear area, the junction being marked by a sharp horizontal line. Splashing sometimes seen at the gas fluid junction.

Percussion. Posterior. Dulness up to angle or spine of scapula, sometimes surmounted by a tympanitic note.

Anterior. Skodaic resonance.

Auscultation. Posterior. Weak or absent breath sounds; tubular breathing passing to weak breath sounds in 2 cases; tubular breathing in 3 cases. Anterior. Weak breath sounds. Coin sound in 3 cases.

PYOPNEUMOTHORAX (Sitting Position). Lung area opacity, bounded above by a sharp horizontal line and surmounted by a clear area. Heart displaced to sound side. Diaphragm immobile on affected side.

Percussion. Posterior. Dulness over lower part. Anterior. Very variable.

Auscultation. Posterior. Tubular breathing or weak breath sounds. Anterior. Tubular breathing or weak breath sounds. (Note.—In three right-sided pyopneumothorax cases tubular breathing appeared over the left base.)

PNEUMOTHORAX. Outline of collapsed lung visible. Unusually clear area lateral to lung and above diaphragm, with absence of lung mottling. Serous effusion soon appears. Adhesion of lung to injured portion of thoracic wall prevents complete collapse of lung. Heart displaced to opposite side.

Percussion. Posterior. Tympanitic. Anterior. Tympanitic.

Auscultation. Coin sound. Tubular breathing (amphoric in cases of open pneumothorax).

Collapse. Opacity of lower part or whole of one lung area, with retraction of heart to opaque side. Diaphragm on affected side high and usually immobile.

Percussion. Posterior. Dulness.

Auscultation. Tubular breathing or weak breath sounds. Occasionally rales or ronchi.

TUBERCULOSIS AND CHEST WOUNDS. Considerable interest has been aroused by the possibility of tuberculosis resulting from gunshot wounds of the lung. Gregoire and Courcoux, in their book, state that research on every approved line has shown that pulmonary tuberculosis is uncommon, and even exceptional, as an immediate or remote sequel of pleuro-pulmonary wounds. Unless the tubercle bacillus is found, fever, loss of flesh, and cough are not sufficient, in conjunction with the physical signs to justify the diagnosis of tuberculosis. Courtois-Suffit²⁶ particularly warns against the tendency to consider recurring hemoptysis as an evidence of tuberculosis. In one of his cases hemoptysis recurred thirty months after the chest wound. A latent inflammatory process or retained foreign bodies may be responsible. In other cases a foreign body, encysted pleurisy or abscess of the lung may give symptoms suggestive of cavity. Even pleural thickening, peribronchial fibrosis and enlargement of the tracheobronchial or mediastinal glands may follow trauma. Gregoire quotes from Sergeant, "that this so-called traumatic tuberculosis is not trauma itself, but its indirect consequences—namely, prolonged suppuration, long confinement in bed in the close atmosphere of a hospital, loss of appetite, and consequently insufficient nourishment." Regarded in this way, any serious wound would have the same effect.

Péhu and Vaguet²⁷ found 3 cases of pulmonary tuberculosis among 146 men with war wounds of the chest reëxamined from four months to three years afterward. In two others there was pleurisy of tuberculous origin. Tecon²⁸ examined 1033 known tuberculous interned soldiers, and found that only 1.1 per cent. had had a chest wound at any time.

LATE RESULTS. Last year I quoted extensively from the excellent paper by Meakins and Walker on the After-effects of Wounds of the Chest. Of 70 cases, they found that about 70 per cent. had evidence of fluid, thickened pleura or both, and that in all except two the physical signs were quite typical of the condition which was supposed to be present. They reported a method for exercising the affected sides. A full description with illustrations was presented in *PROGRESSIVE MEDICINE* (March, 1919).

McMahon²⁹ has published a list of exercises to be given those suffering from lung collapse and chest deformity after gunshot wounds and other deformities of the chest. As a rule the only treatment given such patients is the use of "blow-bottles," an entirely inadequate means of overcoming deformity. The rather complicated method of McMahon, together with those of Meakins and Walker described last year should be familiar to all interested in chest injury and disease.

The Exercises Described. The exercises are as follows. Only a few should be carried out at each treatment, and the advance through the exercises should be gradual and special exercises selected to suit the individual condition. Each particular exercise should be carried out

²⁶ Bull. de l'Acad. de Méd., Paris, 1918, lxxx, 116.

²⁷ Lyon Chirurgie, 1918, xv, 291.

²⁸ Rev. Méd. de la Suisse Romande, 1919, xxxix, 361.

²⁹ Lancet, 1919, i, 697.

18 times, with a rest after each six movements of the exercise. All exercises should be carried out in a recumbent position, with the head and shoulders slightly raised.

1. The operator places his hands on the side of the lower ribs level with the breast-bone. The patient should breathe in through the nose and the lower ribs should be felt to be expanding strongly. There should be as little movement as possible of the upper chest. When the fullest inferior lateral costal expansion is acquired the patient should breathe out through the open mouth and the ribs should be left to regain their normal position.

2. The patient should breathe in in three distinct movements, and the lower ribs should be felt to expand with each breath.

3. The abdominal wall should be contracted inward and then allowed to recover its normal position, so that an in-and-out movement is made. (This is a physical and not a breathing exercise, and can be carried out 20 to 50 times.)

4. Combine the above movements—*i. e.*, the patient breathes in through the nose, and the lower ribs are felt to be strongly expanding. The mouth is opened wide and the abdominal muscles slowly and strongly contracted, so that the air is driven from the lungs.

5. The same inspiratory movement, but the breath should be held and the abdominal muscles contracted in three to five deliberate movements before breathing out.

6. The patient should breathe in deeply, the breath should be held and two more breaths taken in through the nose, and, as air is inspired, two simultaneous contractions of the abdominal muscles should be made. These movements send the air to the apices of the lungs.

7. Bend the body laterally away from the side of the injured lung to the fullest extent, so that the uninjured side of the thorax is partially compressed. The patient is on his back, and the head and feet are drawn around as far as possible. The operator should press over the uninjured lung with both hands and the patient should breathe, as before, in through the nose, and out through the mouth, contracting the abdominal muscles as he breathes out. (When there has been considerable collapse of the ribs on the side of the injured lung, and especially when there has been an abscess in the lung, great care must be taken in doing this movement, otherwise considerable muscular discomfort will occur within a few hours. A certain amount of pain will necessarily be felt if there has been a serious collapse in the chest wall, but this can, of course, be relieved.)

8. The same movement and position, but the operator should press with his hands on the side of the uninjured lung with a pressure of 30 to 60 pounds and the patient should contract the abdominal wall, with the breath held, at first once, afterward increasing by degrees to five times. The following exercises are done with the breath held:

9. Grasp the wrists of the patient as the arms lie at the side of the body, the operator standing behind the patient. Draw the arms outward and upward to above the head, pull on the arms steadily when the arms are at their fullest extent, then relax the pull. The patient should then breathe out quickly.

10. Arms as before. Bring them together in front and carry upward to a right angle. Part the arms strongly backward and horizontally.

11. The same exercise as the preceding one, but the arms are carried backward at an angle of 45 degrees upward.

12. Commence with the patient's arms above the head, with the palms of the hands facing each other. The operator grasps the arms between the wrists and the elbows and presses the arms strongly downward, and when the elbows approach the sides the abdominal muscles should contract. Force the elbows into the side and make the patient breathe out strongly.

13. Grasp the right wrist of the patient with the left hand, carry the arm forward, and bring it to a right angle with the body. The operator should then place his right hand well under the scapula of the patient and pull the arm backward and downward as the patient strongly contracts the abdominal wall. Changing the hands, do the same movement on the other arm of the patient.

14. When there is a painful adhesion between pleura and diaphragm, the operator should stand behind the patient whose arms are fully extended above the head. The patient should then take three deep breaths, expanding the lower ribs as he does so, and as each breath is taken the operator should pull very strongly on the arms. If the patient is of light weight the legs should be held so that the body cannot move.

The average number of attendances on a patient is about ten. Severe cases are given the exercise for several weeks. In all cases the exercises should be continued by the patient himself for at least three months after he is convalescent. The exercises should be carried out twice a day half an hour before meals.

Empyema. In a sense the subject of empyema is being rewritten. The enormous amount of material, clinical, pathological and operative which has been available since the epidemics, has allowed of clinical investigation, research, comparison of operative technics, etc., on a scale hitherto unknown. However, before taking up the discussion, I would advise the readers of these pages to study the paper by Schiller³⁰ published fifteen years ago and containing an account of a symposium on empyema at a German Congress of Medicine. The expressions used in that paper are such facsimiles of those seen now that one might easily accuse many of the writers of the past year of plagiarism. For instance, "The followers of Bülow's method praise its superiority: (1) It avoids pneumothorax. (2) It is the simplest operation, scarcely more than a puncture. (3) It makes only a small wound, and leaves no shock from the operation. (4) It avoids narcosis."

Now the various trocar-cannula methods in use today are only improvements in the form of the instrument. Diederich³¹ in his conclusion states: "(1) The operation is very simple and can be done with the patient in bed as easily as a paracentesis. (2) If done properly, no air enters the pleural cavity for several days." Compare these conclusions with those of fifteen years ago. Schiller gives one of the indications for

³⁰ New York and Philadelphia Medical Journal, June 18, 1904, p. 1185.

³¹ Surgery, Gynecology and Obstetrics, 1919, xxviii, 337.

Bülau's drainage to be cases of acute empyema, not often mentioned, "and which produces a disease of severe form with terrible dyspnea." The incision in the intercostal space, now so ably championed by Moschowitz, is described in detail. So also is Perthe's method whereby suction is applied to the tube by means of a water pump, and differing in principle not at all from the system described by Rockey²² and others.

Why did these methods fall into the oblivion of discarded apparatus and methods? Because, as Hartwell²³ so ably puts it, "gradually, through the constant teaching of thinking masters, this disease has recently been handled along sound lines of therapeutic technic, found on a full comprehension of its pathology. Any falling away from this will only result in a period of again learning old lessons with its resultant suffering.

Our argument may be summed up in the statement that no form of treatment for empyema which disregards the thorough drainage of the chest cavity by a rib resection, and the gradual reëxpansion of the lung by respiratory effort, meets the requirements. Other means will cure a certain number of cases, particularly in such times as the disease occurs in abortive forms, which it has done during the past two years."

Empyema comes to the surgeon early when we term it acute, or late when we term it chronic. The old cavity cases with discharging sinus and bronchial fistulæ are included in the latter group.

ACUTE EMPYEMA. Only brief mention need be made of the hyperacute hemolytic streptococcic infection of the chest tissues with its accompanying pleural exudate. The source of the toxin is mostly in the lungs and next in the mediastinal lymphatics and even in the blood. The pleural exudate is of lesser importance and only to be evacuated to relieve respiratory embarrassment. During the earlier stages the fluid serves as a diluting and healing agent, as nature intended it should. But, as Adami has shown, the inflammatory reaction is apt to get out of bounds and later there will come a time when the chest had best be emptied of its purulent contents. But many men had forgotten the underlying principles. I have referred to Schiller's mention of "Acute empyema;" he further says it is "a condition in which even the most loyal follower of the radical operation would fear the effects of the shock of operation and the narcosis." This was fifteen years ago, and yet it needed terrible experience to again teach the younger generation not to cut a hole in the chest of a man desperately ill or to give him ether as some of them did. Treatment therefore should be palliative by aspiration. As the pneumonic process subsides, the pleural exudate may be absorbed without further treatment; if spontaneous cure does not occur, thoracotomy will be necessary, but should never be done while the pulmonary inflammation is active.

In the case of empyema following pneumonia, the chest lesion rarely accompanies the pneumonic process; it follows on after the latter has entirely or nearly cleared up. Forming in a closed serous cavity, the pus is under considerable tension and compresses the lung, heart, medias-

²² Military Surgeon, 1918, xliii, 384.

²³ Annals of Surgery, 1919, lxx, 55.

tinum or diaphragm. The "wall" of the abscess in time becomes thicker and thicker and this wall is the visceral as well as the parietal layer of the pleura. The principle of treatment is therefore established, to relieve the pressure of the accumulating pus and to prevent the pleura receiving the constant accession of purulent products.

Even in postpneumonic empyema, one may interfere too early. As Moschcowitz³⁴ puts it, the exudate loses its seropurulent character and becomes converted into frank, thick, creamy, pus. Coincident with this conversion, a most important change occurs upon the pleural surfaces; adhesions form between contiguous portions of the visceral and parietal serosa at the periphery of the exudate, which collects in the supra-diaphragmatic portion of the thorax. In other words, by waiting, we have converted the preëxisting free, seropurulent pleurisy, into a closed purulent pleurisy, or empyema, shut in everywhere by limiting adhesions; and thus we have arrived at the second stage.

In 1916, I³⁵ noted from Wilensky's statistics the gradual decline in the mortality percentage up to the seventh, or eighth week, after which it rose again, and stated "that one should wait some days before operating on acute cases." When operation has been decided upon, and the necessary x-ray, physical examinations and needle puncture made, we are confronted by a number of diverging views from the new authorities on the subject.

The question of anesthesia is pretty well settled, nearly every one using local anesthesia. Ether is absolutely unnecessary. A little gas-oxygen may be required sometimes, when the rib is cut.

In the next place, how shall we drain? Through a simple tube introduced by means of a trocar, through one or more tubes after making an intercostal thoracotomy or by the standard method of rib resection? Shall we irrigate with Dakin's solution or not? These are the burning questions of the hour.

Late in 1918, Mozingo³⁶ published the method which he had elaborated at the Walter Reed Hospital. As this paper is so accessible and no doubt already read by most of the readers of this article, extended mention is unnecessary. He introduces a small rubber tube through a 7 mm. cannula held in place by a safety pin and small dressing and kept closed at the tip by a Crile spring clamp. Every two hours by day, and every three hours by night, the accumulated resections are withdrawn by means of a half-ounce bulb urethral syringe, 20 to 60 c.c. or more of Dakin's solution injected and the process repeated until the fluid comes away clear. In from one to seven days the "pyogenic membrane will have been dissolved and the cavity made fairly sterile." He then changes to a 2 per cent, dilution of formaldehyde in glycerin and injects from 3 to 40 c.c. daily every twelve or twenty-four hours. In a few days cultures become negative and the fluid withdrawn becomes serosanguineous. When negative for three successive days, the amount instilled is reduced and the tube removed when the cavity has been obliterated. Those

³⁴ Surgery, Gynec. and Obstetrics, 1919, xxviii, 337.

³⁵ PROGRESSIVE MEDICINE, March, 1916, p. 110.

³⁶ Journal of the American Medical Association, 1918, lxxi, 2062.

intending to use this method must consult the original for many necessary details, the above being a bare outline.

Another example of the trocar-cannula drainage is noted in the article by Diederich³⁷ based on the experience at Camp Pike. A special trocar and cannula were devised, otherwise the method is similar to Mozingo's. Two negative cultures indicate that the washings with Dakin's solution may be stopped and the wound allowed to heal. Curiously, Mozingo wrote a memorandum showing the superiority of his technic over this method after he followed Diederich at Pike, but Dodge,³⁸ Harloe,³⁹ Babcock⁴⁰ and others report cases treated by this method which have since required reoperation. Most of the advantages claimed for the trocar-cannula method are based on the ability to maintain continuous negative pressure, but past experience has shown this to be only rarely possible. Some years ago I experimented with the method of Robinson whereby a silver cannula was screwed on to the rib; it was a failure.

Moschcowitz states that "attempts at maintaining a continuous negative pressure have not been very successful," and yet after describing his intercostal stab, rubber drain, and combined instillation and suction apparatus, he states, that "the vacuum created aids to a limited extent in the expansion of the lung."

It seems to me that there is but little difference in the methods of Mozingo, Diederich, or of Moschcowitz. They will cure a certain percentage of the cases but are all liable to pocketing, persistent cavity or relighting of latent infection. They will be most successful in the streptococcic group. The method of Moschcowitz is the best because he uses the largest tube and therefore gets the best drainage, that of Mozingo the worst because he gets no drainage at all but depends on chemical sterilization for his results.

On the other hand, I cannot but feel that the proper use of Dakin's solution is productive of results although Dodge sees no advantage gained by its use, does not believe that it dissolves inflammatory lymph and thinks that on the contrary it irritates the serous membrane and promotes the formation of thick and resisting lymph deposits. But Stevens⁴¹ was able to complete the records of 123 cases of empyema at Camp Lee, and notes that of 56 cases treated by simple drainage, 25 per cent. recurred. Of 67 cases healed under Carrell-Dakin treatment, only 12 per cent. recurred. Of the simple cases the majority were discovered during the first or second months, either during the routine examination or because of a rise of temperature. Ten of these cases, occurring at the site of the primary operation, were caused by the hemolytic streptococcus, the organism which was the cause of the original infection. The pus collections in the remaining 4 were found either at the apex of the pleural cavity or very high in the axilla, and probably were the result of isolation of a part of the original cavity by adhesions

³⁷ Surgery, Gynecology and Obstetrics, 1919, xxviii, 362.

³⁸ Journal of the American Medical Association, 1919, lxxii, 1808.

³⁹ Ibid., lxxiii, 1874.

⁴⁰ Pennsylvania Medical Journal, 1919, xxii, 69.

⁴¹ Journal of the American Medical Association, 1919, lxxiii, 812.

soon after operation. Although they were all purulent, living streptococci were found in only 2; the others were sterile.

Among the 67 cases healed under the Carrel-Dakin treatment, comprising the refractory empyemas of the earliest group as well as those in which surgical solution of chlorinated soda had been used throughout, there were eight recurrences. Three of these occurred at the site of the previous operation; two of these were due to the hemolytic streptococcus, while the third was merely a collection of a small amount of clear, sterile fluid. Except for a lung abscess found at the angle of the scapula, the remaining five recurrences were at the apex of the pleural cavity. Bacteriologic examination revealed streptococci in two of these cases, *Staphylococcus aureus* in 2 cases, and one was found to be sterile pus.

A study of these recurrences is an interesting demonstration of the efficacy of the Carrel-Dakin treatment. The group treated by this method not only shows a higher percentage of perfect results, but also that the pus pockets which were discovered were usually at some distance from the original focus.

In discovering these secondary foci of pus, there were two symptoms which proved to be of the greatest value: (1) The patients either never regained their normal weight or even lost weight in spite of the fact that they were continuously kept on high carbohydrate diet. In this connection it is interesting to note that in the cases of recurrence in two patients whose weight was above that recorded on admission to the army, the fluid was sterile. (2) In all cases of recurrence of a purulent nature, the pulse-rate was always rapid and there was also a moderate fever. There were, in fact, two different types of fever present. Fever of a very acute nature was found most frequently in cases which had been allowed to close before complete sterility was obtained; in these, the febrile reaction was sharp and was usually accompanied by constitutional symptoms. In other cases a mild evening temperature of 99° to 99.5° F. was observed, especially when the pus pocket was at some distance from the primary empyema and was evidently of long standing.

Babcock is evidently not overly enthusiastic about the value of antiseptic irrigations in empyema. He believes that it reduces odor and pus, but that it shortens the period of the disease is yet to be proved. When he left Fort McPherson, there were about 80 patients still draining and practically all of them had been draining for a year or more despite careful Dakin treatment. Surely these cases were more protracted than cases treated by simple drainage in civilian practice. Was delayed healing due to the unusual virulence or to meddling treatment? Despite Dakin's solution chronic streptococcic infections persist and a collapsing operation or decortication is often eventually needed to obtain a final cure. Even under Dakin treatment, metastatic infections were not uncommon. Men who were doing fairly well would get polyarthritis, or double cardiac or renal lesions, and die in spite of energetic Dakin treatment. We must not forget that Dakin's solution is only a surface disinfectant and that it will not sterilize a thick infected pleura.

It is interesting to compare the results obtained by Whittemore⁴² in a series of 100 cases seen in civic practice. There were 12 cases operated on by the Lillenthal method with one death; 11 by the Carrell-Dakin technic with one death and 66 by catheter drainage with suction and irrigation by Dakin's solution with 4 deaths, a total mortality of 6 per cent. which is indeed a remarkable showing.

At this time I have come to this conclusion: The intercostal drainage methods of Moschcowitz, aided by Dakin solution irrigation, will tide the patient over the critical period when he is feeling the effect of the absorbed toxins and with a minimal risk. If the physical signs and x-ray study show cavity formation three or four weeks later, he will require the usual standard thoracotomy, the rib above the sinus (usually the eighth) being selected for the resection. If the cavity persists and the lung fails to expand or certain complications, such as fistula, develop the case will require the usual collapsing operation after the method of Schede or one of its modern modifications. Moschcowitz gives a very good discussion of these late results in his paper.

One point seems certain, and that is the value of control by culture and cover-glass smear. Garbat⁴³ offers the following explanations for failure of a gradual downward curve after proper treatment:

(a) A secondary small pouch in direct communication with the large empyema cavity exists, and the communication is such that the Carrel tubes do not enter there; thus, there is growth of bacteria in this small pouch, which constantly feeds into the large empyema cavity from which the cultures are made. In such instances, the bacterial count takes an intermittent curve because on some days the Dakin tubes are so placed that the small cavity is disinfected and a consequent drop in the number of bacteria occurs, while on other days granulations are such that the tubes do not slip into the smaller cavity, with a consequent high number of bacteria in the next culture.

(b) Occasionally the necrotic tip of a rib projects into the empyema cavity, and the continuous high count of bacteria from this source persists, and clears up only after the necrotic portion either separates off or is taken care of by the surgeon.

(c) In some instances a persistent high count may be caused by a small gauze sponge or piece of rubber tube left in the empyema wound at the time of operation. In such cases, the cultures show types of bacteria other than the hemolytic streptococcus, either alone or in conjunction with the latter.

(d) Imperfect preparation of the Dakin's solution. Most of us believe that respiratory exercises, especially with Wolfe bottles, are of use, Moschcowitz almost alone dissenting. Tinker shows their value very graphically in a table. He also measured the respiratory gain by means of the spirometer and kept records of the contour of the chest at the beginning and end of treatment by exercises, "setting up," "straddle hop," etc. All empyema patients took this work. Twenty-cases have been followed by careful measurements. Their progress for

⁴² Boston Medical and Surgical Journal, 1919, cxxxii, 575 and 692.

⁴³ Journal of the American Medical Association, 1919, lxxii, 330.

five weeks was tabulated as follows: Average gain in chest circumference, 3.7 cm.; average gain in chest expansion, 4.3 cm.; average gain anteroposterior diameter, 1.3 cm.; average gain abduction of arm, affected side, 40 degrees; average gain forward motion of arm, 35 degrees; average gain backward motion of arm, 32 degrees; average gain endurance test, 20 minutes; greatest gain in weight, 22 pounds; least gain in weight, 3 pounds; average gain in weight, 17 pounds.

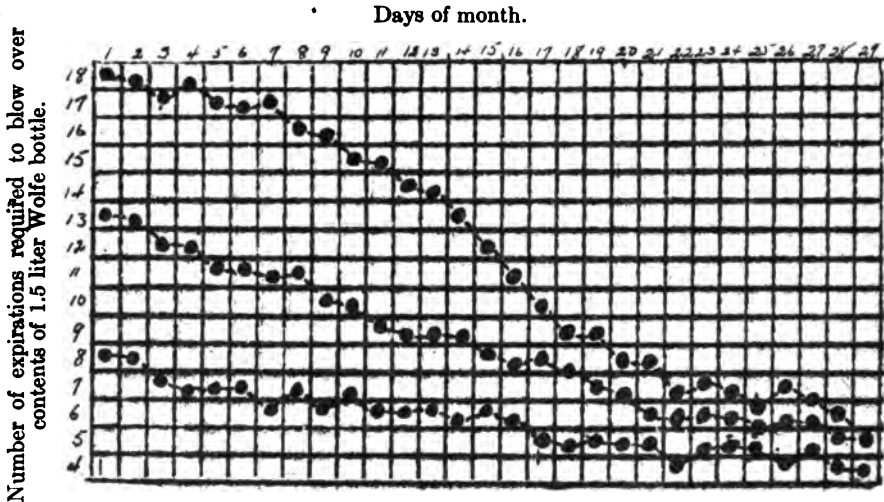


FIG. 52.—Curves showing progress in exercise on Wolfe bottles; Upper curve shows best gain in number of expirations required to blow over contents of 1.5 liter. Wolfe bottle; middle curve, the average gain; lower curve, the poorest record.

CHRONIC EMPYEMA. By this group I mean those more or less imperfectly treated during the acute stage and who come to us with sinus or cavity or both. I feel sure that there the technic as practised at Fort DesMoines (U. S. G. H. No. 26) by Tinker and Wattenberg⁴⁴ warrants a careful trial before we proceed to do a Schede operation or one of its modifications.

The first essential is an enlargement of the existing inadequate opening until there is room for from 4 to 6 Carrel tubes, depending on the capacity of the cavity, and at least a $\frac{1}{4}$ inch drainage tube. This is done by introducing a tube each day which is one size larger than the previous tube. Often the scar tissue was dilated with much difficulty and the patient suffered so much discomfort, that the same tube was obliged to remain in the sinus for forty-eight hours. Rarely was there an instance where a tube the size larger could not be used at the end of that time. While this process of dilating these sinuses is going on, the patient must not expect to be very comfortable, at least not immediately after the introduction of the new tube. As long as it takes place of an operation, if this is made clear to him, the average patient will be glad to content himself with some degree of discomfort, to forego the more radical

⁴⁴ Annals of Surgery, 1919, lxx, 552.

procedure of an operation. At worst, it will not be as incapacitating to him for the time being as an operation.

This method of dilation is not possible if bone has regenerated and united the rib. This can usually be determined at the first examination by introducing an 8-inch Kelly-Pean forceps into the sinus and attempting to spread it. The resistance felt if there is a ring of bone can scarcely be mistaken. In such cases a formal operation must be performed and rib resection resorted to. If the drainage is at the bottom of the cavity, the rib above the sinus may be chosen; if not, the rib below must be resected. In order to minimize hemorrhage, the incision should always follow the line of the ribs. On getting down to the pleura, if there is found the usual thick fibrinous exudate covering it, an opening through this must be made by excision of this tissue. Any hope of making an incision into this tissue and then stretching the opening to sufficient size so as to admit the tubes will meet with failure. There is a tendency toward rapid closure of the wound. The opening



FIG. 53.—Specimens of ribs removed from cases of chronic empyema, showing reformation of bone about drainage tubes, following rib resection.

made may vary somewhat with the size of the cavity since a smaller cavity, other things being equal, will require the same number of tubes for a shorter time before sterilization. In most cases it is safest to make an opening at least two to three inches in diameter. If any of the organized exudate is present, this is removed.

Wattenberg finds that local anesthesia, though doubtless the choice of anesthetic in primary cases, is not ideal in these reoperative conditions. The extensive scar tissue infiltrates with difficulty, and where manipulation of the ribs at operation is as extensive as must be the case where the rib above and the rib below have bony connection with the one which the operator is attempting to remove, it is quite unsatisfactory. Nitrous oxide anesthesia is ideal, and was used in practically all cases.

If cavities are found, they often can be made to coalesce by breaking down gently with the gloved finger the partitions, thus forming one cavity. In each cavity 6 to 8 Carrel tubes are placed, and one or more of the large size drainage tubes are used to fill in the opening and to keep it open. Gauze is packed into the wound snugly about the tubes.

Dakin's instillation is usually begun the same day, and continued every hour during the daytime and every two hours at night. During each instillation the patient was required to lie down for five or ten minutes in the hope that this would give an opportunity for better application of the antiseptic. A sufficient quantity is used to overfill the cavity even if the external dressings must be changed oftener than once a day. At dressing, the skin was cleansed about the wound with benzine, the cavity irrigated with Dakin's solution until the fluid returned perfectly clear. After having cleansed the skin with benzine, it should be dried with sterile cotton handled with forceps. Vaseline gauze is placed about the wound to avoid burning. The tubes are again placed in different directions and the rest of the opening is utilized by the large size drainage tube. The sizes of the drainage tubes can be made smaller as the condition improves. If kept sufficiently open, dressings are painless, but forcing the instillation tubes into an opening that is too small is painful, and, furthermore, it occludes the tubes.

Cultures were taken from the wounds of all the patients twice a week. Immediately after removing all the dressing and all the tubes from the wound, a platinum loop full of pus was procured from the cavity. The same loop was used for the same patient each time. The loopful of pus is placed into a sterile test-tube containing $\frac{1}{2}$ c.c. of one-half of 1 per cent. of sodium thiosulphate to neutralize the Dakin's solution. The culture then is plated on blood agar. The plates are incubated twenty-four hours. At the end of that time they are examined. If the colonies are numerous, the plate is examined under the microscope. A piece of paper having a hole of four square millimeters is placed into the ocular, and the number of organisms estimated for the standard platinum loop. Five fields are counted and an average is taken. If the colonies are sparsely scattered, a field ten millimeters square is used with naked eye, and the total estimated. The percentage of hemolysis is estimated by comparing the plate examined with a pure blood plate. If hemolytic streptococci are present the total of these, per plate, is counted. This manner of estimation is, of course, only approximate, but it is practical.

The cases are terminated in one of two ways: (a) Cavity closure. When the cavity had diminished to a sinus, dichloramine-T (5 per cent.) was used every three hours, and Dakin's solution discontinued. From then on only the drainage tube was left, and it was shortened once a day, the amount of shortening depending on the rapidity of closure of the sinus from within. The cases closed and were healed on an average of ten days after having reached the sinus stage. So far, none has reopened. (b) Cavity sterile. When a negative culture from a cavity was obtained, that cavity was cultured daily until there were seven successive negative cultures. Then all tubes were removed, a thick gauze dressing snugly applied, and the cavity permitted to close. The dressings were not changed unless they were soiled. The lung filled in the cavity readily and thus far none has given further trouble. Often the cavities closed from within before being completely sterilized. There were 62 such cases. None, however, has ever closed in this manner until the disappearance of the hemolytic streptococcus. When the cavity has been

sterilized and all the tubes are removed, the opening may close before the cavity itself is entirely obliterated. There will be formed a pneumothorax. This will take care of itself. It soon disappears without further treatment. There were several such instances.

LUNG SUPPURATION. A number of interesting points in the pathogenesis and symptomatology of abscess, gangrene and bronchiectasis of the lung are brought out by Wessler,⁴⁶ after a study of 100 cases. Of these, 26 were postoperative, 21 following tonsillectomy, and Wessler believes that the infection in such cases is primarily gangrenous and owes its origin to definite forms of anaërobic microorganisms. A localized bronchiectasis is formed, with a secondary pneumonitis, gangrene and abscess. The pathology of so-called postpneumonic abscess is more obscure. It commonly results from an attack of bronchopneumonia, which is frequently of the grip type. Instead of resolving in the normal way, the infiltration persists and acquires a fibrotic character with a resulting induration of the lung. As a result of pressure of the fibrous tissue on the smaller bronchioles, numerous cylindric bronchiectases develop. This is evidenced by persistent fever, cough, increasing expectoration and occasional hemoptysis. The entire process is slow and subacute, and it is months before the outspoken symptoms of lung abscess develop. The relation of gangrene to these cases is variable. In many cases it appears only late and may be only a transient manifestation. In a large percentage of the cases at some time during the course of the disease, the patient expectorates fetid sputum for a few days. But at any time, it may become a major factor, and, by causing a rapid breaking down of the lung tissue, it may convert a relatively benign case into one that is rapidly fatal. In another group, Wessler places 16 cases presumably postpneumonic but which he suggests were due to the aspiration of septic material from the teeth or the tonsils, perhaps in the act of snoring during sleep. That this is not improbable will be evident from a consideration of several of the cases in which aspiration gangrene developed during unconscious states. This occurred in one case after an overdose of morphine, and in another after alcoholic coma.

The symptoms and other evidences of the disease in this group differed in no wise from those in the aspiration cases. Wessler brings out the point in regard to surgical treatment which is not often emphasized. A study of the cases recorded that at least one-third of the patients with aspiration abscesses recover spontaneously, usually within a period of two months. For this reason, any operative procedure for the cure or relief of lung suppuration may profitably be postponed for several months. He formulates the operative indications for resection as follows: "The patients must be young; the operation in those who have reached the age of forty has a prohibitive mortality. The case must be uncomplicated, that is, the pleural cavity must be free of dense adhesions so that the lobectomy may be expeditiously performed. Operations which last much over an hour result in a high mortality. The disease must be unilateral."

⁴⁶ Journal of the American Medical Association, 1919, lxxiii, 1918.

Green,⁴⁶ states that thoracotomy and drainage will be the usual method of surgical treatment but in the indurated abscesses it may be that the resection of a lobe of the lung is the only procedure which will effect a cure. Wessler, however, thinks that drainage of the cavities, while it may produce a distinct improvement in the condition of the patient, cannot accomplish complete removal of the infiltrated lung.

ARTIFICIAL PNEUMOTHORAX IN LUNG ABSCESS. Mention has been made in a previous review⁴⁷ as to the use of artificial pneumothorax in the treatment of lung abscess. A number of reports have recently appeared relating experiences with this method of treatment. Thus, Goldberg, and Biesenthal⁴⁸ state that this method offers distinctly better advantage of success than the ordinary medical and surgical procedures heretofore used. Collecting the 16 cases thus far reported as having been treated by artificial pneumothorax, including the 3 in their own experience, the authors find that 75 per cent. have been improved, and 12 per cent. have died.

Tobiesen,⁴⁹ De Verbizier and Loiseleur,⁵⁰ Rist,⁵¹ and others, also report successful cases. Tobiesen had one failure because of adhesions. Wessler, on the other hand, fails to see how the injection of air into the pleural cavity may be expected to cure these patients. The conditions present bear no similarity to those which obtain in tuberculosis. It is not desirable to stimulate fibrosis, as there is already a tendency to fibrosis. The collapse of a cavity, if this is possible, which is doubtful, will not bring about the removal of a gangrenous focus. Not only is this procedure of no value, but it also may be distinctly harmful. The collapse of the lung may lead to a dissemination of septic material into distant portions of the lung, with a rapid extension of the disease. In 2 of the cases in the series studied by Wessler, artificial pneumothorax was performed, and not only was there a marked extension of the disease to be observed on the roentgenogram, but also both patients died suddenly shortly after the last insufflation.

Green also objects to artificial pneumothorax "because in the very spot where one desires the lung to be collapsed adhesions keep it fastened to the parietal pleura."

THE ESOPHAGUS.

Esophageal Diverticula. This interesting anomaly presents many points of interest from the embryological and etiological standpoints. The following complete classification is taken from Halstead.⁵²

A. Pressure or pulsion diverticula:

1. Those of the pharynx.
2. Those of the pharyngo-esophageal junction: the border-line cases or the Grenz diverticula of Rosenthal, also know of Zenker's diverticula.

⁴⁶ *Annals of Surgery*, 1919, lxx, 539.

⁴⁷ *PROGRESSIVE MEDICINE*, March, 1919, p. 149.

⁴⁸ *Am. Rev. Tuberc.*, 1919, iii, 169.

⁴⁹ *Ugeskrift Laeger*, 1918, lxxx, 1577.

⁵⁰ *Bull. de la Soc. Méd. d. Hôp.*, 1918, xlii, 1139.

⁵¹ *Ibid.*, 1919, xliii, 652.

⁵² *Surg. Clinics of Chicago*, 1919, iii, 667.

3. Diverticula having their origin near the bifurcation of the trachea just above the left bronchus. These are the epibronchial diverticula of Leutgert.

4. Deep-seated diverticula, mostly found near the esophageal opening in the diaphragm. These are also called epiphrenal. The orifice is generally a short distance above the diaphragm, the fundus of the sac resting upon it.

B. Traction diverticula.

C. Traction-pulsion diverticula.

The pulsion diverticula are the most important and a minute description will be found in Halstead's article. Additional information will be found in the recent papers by Mosher,⁵³ Judd,⁵⁴ and Hendon.⁵⁵ The symptoms and points in diagnosis are given in all these papers but as they are accessible in the larger text-books, the following table from Judd only need be added:

Males	28	
Females	7	
Average age	54	years
Average duration of symptoms	5½	"
Difficulty in swallowing noted in all of the 35 cases.		
Regurgitation of food noted in 30 cases.		
First symptoms noted:		
Difficulty in swallowing	13	cases
Gurgling noise in throat	12	"
Regurgitation of food	8	"
Choking sensation	2	"
Tumor of the neck visible or palpable (left side 7; right side 3)	10	"
No loss of weight in	8	"
Loss of weight in	19	"
Average loss	27	pounds
Greatest loss	65	"
Weight not given in	8	cases
X-ray diagnosis of diverticulum of the esophagus in	24	"

Treatment. The only rational treatment of pulsion diverticula at the pharyngo-esophageal juncture is by operation. Two methods of dealing with the sac have been employed:

1. Invagination of the sac into the esophagus and closure of the inverted orifice by purse-string suture—the method of Girard. This method should only be used when the sac is small—not larger than the terminal phalanx of the thumb.

2. Isolation of the sac and excision, with closure of the wound in the esophagus by suture.

Halstead advocates two sittings: at the first the sac is explored by a long incision parallel to the anterior border of the sternomastoid. The neck of the sac is sought for at the level of the cricoid cartilage, its identification being facilitated by passing an esophageal bougie into the sac *via* the mouth. The sac is separated by blunt dissection, twisted on its transverse axis and fixed by suture to the skin at the upper angle of the wound. The bed of the sac is packed with gauze and the skin

⁵³ Surgery, Gynecology and Obstetrics, 1917, xxiv, 175.

⁵⁴ *Ibid.*, 1918, xxvii, 135.

⁵⁵ American Journal of Surgery, 1919, xxxiii, 68.

closed by suture. After four or five days the gauze packing is removed. The patient may swallow food. In a week or ten days the wound is reopened, a purse string inserted at the base of the neck of the sac, the latter divided with the cautery, the stump invaginated and the purse string tied. The wound is closed with temporary drainage.

The first method mentioned above was described by Bevan⁵⁶ in 1917. He used a series of purse-string sutures by means of which the sac itself is not removed but is gradually folded up and turned into the lumen of the esophagus. Judd, as well as Halstead, advocates this method in small sacs. If large, Judd prefers the two-stage operation as devised by C. H. Mayo. The sac is first dissected out of the thorax, leaving the neck attached without opening the sac during the first stage. After it is entirely freed, the wound in the neck is sutured and the sac left outside of the neck in the dressing. The skin edges are sutured to the esophagus at its juncture with the diverticulum. After ten or twelve days adhesions have formed about the sac and it can be removed without an anesthetic and the edges turned into the esophagus. Judd reports 35 cases operated on at the Mayo Clinic as follows:

The sac was excised and the base inverted in	18 cases
The sac was excised and the base ligated and turned in	4 "
The Bevan operation was done in	3 "
The two-stage operation (C. H. Mayo) was done in	10 "

There were two deaths following operation, both on the second day. Both patients were known to be poor surgical risks; one a male aged seventy-six years, the other a male aged seventy-three years. The cause of death in both instances was cardiac disorder. One died after the first of a two-stage operation; one after excision of the sac and inversion of the base.

Mosher is not so keen about the dissection methods. He has recently devised a new method of treatment, viz., dividing the common wall between the diverticulum and the esophagus. The primary step is to locate the opening of the pouch and also that of the esophagus, which is best accomplished under ether with a "ballooning" esophagoscope. Then with scissors the wall is divided to within one-eighth of an inch of the bottom, this small rim being left to avoid opening the mediastinum. There is but slight bleeding, the field being kept clear by suction. The patient is nourished by rectum for two days; bougies are passed at the end of a week. The ultimate fate of the sac after cutting its wall has not yet been determined, but the outcome in 3 cases leads the author to conclude that the procedure is easily accomplished, is probably safe, and results in a clinical cure.

⁵⁶ *Surgical Clinics of Chicago*, 1917, i, 449.

INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA.

By JOHN RUHRÄH, M.D.

From the standpoint of infectious diseases, the past year has been very remarkable. In the first place, though perhaps not the most important, was the devastating epidemic of influenza followed by a veritable flood of contributions dealing with every phase of the disease. The studies of influenza are preceded by a short résumé of the subject, so that the reader is referred to that section of this article for further information. It is important to note the influence of the studies of influenza on the trend of thought of the investigators. Among the other work done on this subject were investigations along the line of its causation by a filtrable virus and this led to the study of other diseases, so that the past year may be regarded as one in which the stage was occupied chiefly by the filtrable viruses and the diseases supposed to be caused by them. Among these may be mentioned not only the influenza epidemic, but epidemics of lethargic encephalitis, an epidemic encephalitis of a somewhat different character observed in Australia; the occurrence of acute infective polyneuritis. From all these diseases a filtrable virus was isolated, the disease was transmitted to animals and the virus recovered from them, the most important contributions being made by Bradford, Bashford and Wilson.

Another remarkable feature of the past year or so was the widespread prevalence of a pneumonia due to the *Streptococcus hemolyticus*. This disease was very prevalent in the training camps; it followed measles and also complicated influenza. This pneumonia is entirely different from the ordinary lobar type, and, as long as it is with us, is going to change the diagnosis, prognosis and the mortality rates. The subject is discussed more fully under the head of Influenza.

It is remarkable that at least three diseases, either new or not usually noted, should be described in one year. One wonders whether the opinions of Crookshank anent their relation to influenza are not justified. Perhaps more important than all others if it is verified is the isolation by Noguchi of a leptospira which he believes to be the cause of yellow fever. This organism is in some stages filtrable and resembles the leptospira icterohemorrhagica of Inada and Ido. Many competent observers have studied yellow fever with a view of isolating the etiologic factor, and just as many are the remarkable failures to do so. The history of this disease is unusually full of attempts to prove this or that organism as the cause, the most notable being the report of some twenty-odd years ago made by Sanarelli. He, it will be remembered, isolated

an organism which apparently fulfilled most, if not all, of the necessary conditions. This organism soon proved not to be the cause of the disease. If Noguchi is verified, it will mean another remarkable contribution by this remarkable investigator.

Botulism, infections from spoiled food have had a renewed interest, due doubtless to the fact that many amateur canners sprang up as a result of the food-saving campaign of the Government; a number of extraordinary cases and studies are recorded, and it is exceedingly important that the practicing physician be familiar with such cases as they may otherwise be mistaken for other diseases of the nervous system or poisoning.

As might be expected, meningitis has come in for a very considerable amount of attention and the reader is especially recommended to the work of Herrick and Dannenberg on the cerebrospinal fluid findings in diseases other than meningitis, and the work of the first observer on the subject of extrameningeal infections.

Antimony tartrate as a remedial agent has come far since it was first described by Adrien Mynsicht in 1631. From an agent to fatten friars, it has passed through many changes and put to many uses, the last, perhaps the most important of all its employment, as an agent against the organisms causing kala-azar and bilharziasis.

The fifth report of the International Health Board of the undertakings of the Rockefeller Foundation contains much that is worthy of attention. The map of the world showing its several activities is very suggestive when one sees that the hookworm campaign is being carried out in the far islands of the Pacific, to the islands of the Atlantic, and in every continent except Europe. The chief work is being done in the southern States of this country, in our island possessions, and in South America. The southern States are fast approaching a campaign looking to the eradication of malaria, while the yellow fever campaign is being pushed actively in the northern part of South America and in Central America. There would seem to be hopes that this terrible scourge may entirely be wiped off the face of the earth.

The tuberculosis work has been largely confined to France, and the public instruction to the School of Hygiene of Sao Paula in Brazil. This is headed by Darling, as Professor of Hygiene and Public Health, and will give this brilliant investigator a new field of activity.

The Lessons of the War. It is about as difficult to condense Sir Almroth Wright and make the result readable as it would be to do the same thing to Bernard Shaw. One should, therefore, read a lecture by the former, published in the *Lancet*, March 29, 1919, p. 489. The lessons of the war, according to this writer, are two—the first that if the proper conditions are provided by the surgeon; *i. e.*, that he excises dead and badly infected tissues and closes the wound, the tissues and the leukocytes are capable of dealing with every kind of infection. The second concerns typhoid inoculation, which has demonstrated so conclusively—even a Christian Scientist must admit it—that the natural powers of resistance of the human body can be powerfully reinforced by inoculation. The principle of inoculation is old, hoary with age; and was doubtless old when

Mithridates tried to render himself immune to poisons by eating ducks that had fed upon toxic substances, but the practical application was not used because it seemed illogical to introduce into an already poisoned body more of the same substance. Not until Pasteur showed that it was possible to beat disease by taking advantage of the incubation period was protective inoculation made possible through an intelligent understanding of at least one phase of it. Two questions arise: At what time is the body mastered by the invading organisms and is a localized infection one which has been arrested in the incubation period? To approach the subject properly, it should be remembered that there may be only a localized response to the action of the microbe, or it may be generalized. The former, in many instances, is the period of incubation.

Vaccine therapy is usually unsatisfactory where there is continued constitutional disturbance and recurring pyrexia, in unopened abscesses and sloughing wounds and in long-standing infections. Wright introduces a number of new technical terms, perhaps unavoidably, but he gives an interesting explanation in lieu of an apology for adding to the burden imposed by terminology. He calls the new technical terms the missionary of the idea, and one might add they are about as welcome.

Lord Moulton calls the power of the body to protect itself from infection, *phylactic power*. This power resides not only in the leukocytes and the bacteriotrophic substances in the blood, but also in the ability of the body to marshal these forces and transport them to the infection point, this is *kata-phylaxis*, and anything which interferes with this is *anti-kata-phylaxis*, such as blocking of arterial supply, or the action of severe cold. The reserve power of the body he terms *epiphylactic response* or reinforcement. If too large doses of vaccine are employed, a lessening of blood resistance may follow—the negative phase—for which he proposes a new name, *apophylactic phase*. If in a region of the body the guardian forces have been rendered impotent, this process is *ec-phylaxis*, the region the *ec-phylactic* region. Some twenty years ago Wright used for the same ideas the term regions of diminished bacteriotrophic resistance, etc. These missionary words failed and evidently, like the dove finding no place to light, the nimble-witted Wright sends out some new ones. This sin of coining new words is great, it makes medical reading as difficult to the average physician as though it were translated into a foreign tongue. The ideas, instead of being made clearer, are embalmed; a hundred years or less hence these articles will be as unintelligible to the average reader as some of the works of John Mayow or Francis Glisson.

In a preventive inoculation, a normal phylaxis is reinforced by the epiphylactic response and the kata-phylactic arrangement may be depended upon. In therapeutic inoculation, if either epi-phylaxis or kata-phylaxis fail, the efforts are pretty certain to miscarry. In the continued pyrexia cases, alluded to as giving poor results, the epi-phylaxis is at fault; in the unopened abscess, kata-phylaxis fails. The reader is now prepared to appreciate what follows, and one might add parenthetically that the remark of Lowell about science peddling with the names of things, takes on a new meaning.

The cause of failure in vaccine therapy is less apt to be from epiphyllactic failure, *i. e.*, the failure of the resisting power of the blood fluids. When it occurs, rest is indicated. If it is a slight local infection, immobilization may be all that is needed, but in severer forms, no matter what the underlying cause, rest in bed is imperative. Local abscesses and the like require evacuation. This is also needed as a kata-phyllactic measure, as it permits the leukocytes and blood serum to penetrate an otherwise impermeable area, increasing the flow of lymph to the part and simple diffusion may also be resorted to. In practice, the first is accomplished by incision, incision and cupping, the application of hypertonic salt solution to a naked tissue, and the application of irritant solutions to naked tissues. Transudation is effected by hot fomentations, Bier's bandage—which, by the way, was clearly described by that neglected genius, John Mayow, in the seventeenth century—and massage. The diffusion of protective substances is increased by the surgical procedures, the need of which were emphasized in the recent war, the opening of abscesses, the cleansing of putrid sloughs, the excision of dead tissue, etc. Two types of infection were met with, "foul wounds" and "clean wounds." In the former, the exudate has a reduced tryptic power and most organisms grow freely (Wright's *serosaprophytes*). In clean wounds, the exudate is normal as regards its antitryptic power and is inhabited generally by staphylococci, streptococci or diphtheroids (Wright's *serophytes*). A foul wound can be rendered clean by bringing into it sufficient normal blood serum, but, once clean, to bring more serum is to increase the culture medium of the serophytes. The serophytic infections must be combated by the leukocytes. In serum the microbes are destroyed by phagocytosis, in salt solution this is accomplished by the leukocytes without phagocytosis which power Wright proposes to call *telergic action*. The suturing of infected wounds is successful when pus is not left behind, nor dead spaces, but the leukocytes must come from the blood, else failure will result.

The weak point in the natural defence is that the blood-serum furnishes a culture medium for serophytic microbes. As a result of infection by some organisms and by inoculation, the blood may have its antitryptic action increased and so be a less favorable medium for serophytes. This Wright has demonstrated in some well-planned laboratory experiments, and he found that the blood acted upon both streptococci and staphylococci, a fact which opens up the important field of non-specific immunization. It was also shown that blood *in vitro* reacted as it did *in vivo*, and the bactericidal power could be increased by inoculation. The question of *specificity of immunization* is raised, and it is one of extreme interest and importance. Heretofore, specificity has been an article of faith and any statements to the contrary have been given scant consideration. Such statements as were made twenty years ago before the Indian Plague Commission that antiplague inoculation had cured eczema, gonorrhea, and other infections, were not even thought worthy of attention. Later, in the Transvaal, the records showed that pneumonia vaccine reduced the mortality 85 per cent. and that of other diseases 50 per cent. This collateral immunization is of great impor-

tance. There is an old axiom in public health work—the Mills-Reincke phenomenon—that if the mortality for one disease is lowered, there will be a lesser, but distinct, lowering of the rate for other diseases.

This has already furnished food for much thought, but it should furnish more. Instances are observed in which stock vaccines have given better results than autogenous ones. The best vaccine to use is the one which gives the best results in any given case, that is, the one which gives the best immunizing response.

Wright and his co-workers believe that it will be possible to test the patients' blood as to the effect of the vaccine *in vivo*, but also *in vitro*, so that the effect on the patient may be determined before the inoculation is actually given.

This leads up to another phase of the subject of *immunotransfusion*. This consists of taking the donor's blood, immunizing it *in vitro*, to render the plasma bactericidal for the microbe with which the patient is infected, and then injecting it. He outlines this procedure as follows:

"The case I have here in view was that of a patient who was the subject of streptococcal wound infection with extensive involvement of the sacrum and ilium, and who was suffering from a continuous high temperature, which had reduced him to such a condition that his life was despaired of. A secondary very radical operation, with chiselling of bone, having under these conditions been undertaken without any improvement in his condition, it was determined to try a transfusion of blood which should be immunized *in vitro* against the patient's streptococcus. With a view to ascertaining whether such a blood could be obtained for the patient, a syringe of blood was taken from the appointed donor on the day before that fixed for the operation, and different portions of this blood were digested for three hours *in vitro* with a series of graduated dilutions of a staphylococcus and also of a streptococcus vaccine. The centrifuged sera, with controls, were then implanted by the wash and after-wash method with a mixture of staphylococcus and the patient's own streptococcus. Of all the sera thus obtained, that of the blood portion which had been digested with 1000 staphylococci per c. c. gave the best result. While the serum from the control blood grew staphylococcus up to the thirteenth, and streptococcus up to the fourteenth, dilution, the serum from the blood which had been digested with 1000 staphylococci per c. c. grew the staphylococcus up to the ninth and streptococcus only up to the sixth dilution. In view of this result we added to the liter of blood, which was drawn off from the donor into a paraffin-coated receptacle, a quantum of vaccine corresponding to 1,000,000 staphylococci. After the transfusion of this blood, a very striking change came over the patient's condition. His temperature promptly fell and he rapidly became apyrexial. The wound also rapidly healed; and his serum, which before provided for the streptococcus a much better culture medium than our normal sera, was found after transfusion to inhibit the growth of this organism."

These ideas of Wright's are of extreme interest and extreme importance. He is certainly one of the workers in scientific medicine who are endowed with more than their share of imagination, and imagination is

a function not to be despised in research work, for without it the investigator usually merely follows out and confirms what has been done by others. All of the points mentioned above have been demonstrated in series of very beautiful laboratory experiments, and the original is well worth perusal.

The History of Epidemic Encephalomyelitis. Crookshank¹ has made a study of unusual interest in which he points out that the clinical manifestations which of late years have become associated with the names of encephalitis acuta hemorrhagica, polyneuritis, poliomyelitis, etc., have doubtless prevailed from time to time during many centuries in epidemic form. Crookshank, from a careful examination of the earlier literature, together with that of more recent times, is of the opinion that what is now called encephalomyelitis has been recorded for at least four hundred and fifty years, and that most of the epidemics have been noted as incidental to major epidemics known historically as sweating sicknesses, influenza, epidemic catarrhs, and the like. The special epidemics have usually appeared either shortly before or shortly after one of these major disturbances and in essentially the same geographic region.

Whether Crookshank's opinions will be found to be tenable or not is a question for time to decide. He has, however, produced an exceedingly important and very readable paper, which is to be republished in the *Boston Medical and Surgical Journal*, and which everyone interested in the subject of encephalitis and influenza should read in the original.

The Diseases Caused by a Filtrable Virus. The difficulties heretofore surrounding the study of the filtrable viruses are gradually being overcome, particularly by Noguchi and some of the other workers in this difficult field. The past year has seen a renewed interest in the diseases so caused and a number of remarkable, very positive results have been obtained. In addition to the references which have been made throughout this review, which need not be repeated, it may be well to add that in all probability such diseases as affect the nervous system like poliomyelitis, rabies, lethargic encephalitis and infectious polyneuritis are doubtless all due to microbes which at some time in their evolution are sufficiently small to pass through a Berkefeld filter. It is quite possible that such diseases as mumps, measles, German measles, scarlet fever and the like are also due to organisms of an extremely small size. The inherent difficulties in working with these organisms makes it imperative that only individuals especially trained should venture into this field. With workers of average ability, the difficulty of mistaking the products of autolysis for organisms is great. Bradford, Bashford and Wilson² have made some extraordinary claims as regards discoveries of various filtrable viruses, part of which they have subsequently retracted, so that at the present time we are in a state of incomplete knowledge of exactly what they did accomplish. A review of their work is given under the appropriate headings.

¹ Proceedings of the Royal Society of Medicine, 1919, vol. xii (Section of the History of Medicine, p. 1).

² British Medical Journal, May 17, 1919, p. 599.

In addition to some observations on influenza and polyneuritis, it may be well to call attention to the fact that Hort,³ in a short communication, called attention to the fact that he, in connection with Ingram in May, 1914, found organisms in connection with typhus fever. Since that time he has published a number of communications and still has a considerable amount of material which is yet unpublished. He has found a filtrable virus in a number of different diseases, including scarlet fever, measles, German measles, mumps, pneumonic infections and cerebrospinal meningitis.

Contagion in Institutions as Affected by Visitors. This is a subject which has never received the proper amount of attention. In most institutions for children there are one or more visiting days a week at which time friends and relatives are allowed to flock into the institution, sometimes into the wards or rooms occupied by the inmates, in some institutions they are restricted to certain rooms set aside for visitors, but at any event there is a certain amount of close contact among the children and persons from the outside who may be carriers of disease. The whole subject is one which deserves a careful study at the hands of health and institutional authorities, and it is high time that some simple yet effective method of combating this source of danger should be in uniform use.

The New York health authorities⁴ call attention to a small epidemic of chicken-pox in an institution for girls, which resulted from the lifting of the ban against child visitors. In this particular institution the usual rule has been to admit no visitors under sixteen years of age, and the place has been relatively free from infectious diseases. Whenever the practice has been allowed to lapse, the penalty is invariably paid. It was amply demonstrated during the epidemic of influenza that institutions enforcing strict rule against all visitors and probably safeguarding the inmates remained free from the epidemic.

Antagonism between Microbes. This very interesting subject has never received as much attention as it deserves, and in the basis of it may be found some new methods of securing immunity to disease and cures heretofore not suspected. Spada⁵ noticed that individuals suffering with a staphylococcus infection, if infected with anthrax had the latter in a very mild form. This adds a new antagonism to the list which the author confirmed by experimental work on guinea-pigs and rabbits. The mixture of staphylococci and anthrax bacilli, when injected subcutaneously, induces the formation of an abscess at the point of injection, and a great increase in the number of leukocytes, and probably has a great deal to do with the defences of the body against the infection by the anthrax bacillus. When the mixture was injected intravenously the animals all died, and this seemed to be in accord with the suggestion just made.

³ British Medical Journal, February 22, 1919, p. 230.

⁴ Weekly Bulletin of the Department of Health, City of New York, November 1, 1919, p. 347.

⁵ Rev. Sud-Amer. de Endocrinologia, etc., Buenos Aires, May 15, 1919, No. 5, ii, 149.

The anthrax bacillus cultivated *in vitro* with the diplostreptococcus isolated from cases of influenza, seemed to have their virulence destroyed. Other antagonisms which have been noted are the well-known ones between the Staphylococcus aureus and diphtheria, the liability of malarial subjects to have dysentery and smallpox but not tuberculosis; that malaria parasites disappear from the blood in intercurrent smallpox, and, according to Aynaud, during severe influenza. In similar ways, whooping-cough is often markedly lessened by intercurrent diseases, and vaccine for smallpox has actually been advised and used for the purpose of lessening the paroxysms. It would seem that we are beginning to get a sufficient number of facts concerning antagonism and, on the other hand, of affinities to lead to something of practical value.

In this connection the comparative absence of other infections during the influenzal epidemic may be mentioned, and the New York Health authorities⁶ in May, 1919, states that in the few preceding months there had been a very remarkable decrease in the more serious contagious diseases of childhood, with the exception of diphtheria, measles and whooping-cough, being somewhat less than one-half, a distinct lowering in the number of cases, though not in the deaths, of scarlet fever, while there was a slight increase in diphtheria. Whether these changes were due to the effects of influenza or not it is impossible to state, although it seems probable that it has something to do with them.

The Immunity of City-Bred Recruits. That city-bred men, when crowded together in army camps, are less liable to infection than their brothers from suburban or rural districts has been noted a great many times since the beginning of the late unpleasantness. It will hardly be necessary to go into the details of the subject which has been admirably worked out by Love and Davenport.⁷ They have shown that the highest morbidity and mortality rates have been from camps that drew from the sparsely populated areas and to a less striking extent from the sparsely settled states of the West. This generalization is the result of a careful study based on mumps, measles, lobar pneumonia, scarlet fever, cerebrospinal meningitis, and influenza. The explanation ordinarily offered is that recruits from the cities have acquired immunity from having had the diseases in their youth. This, however, does not explain the rarer diseases of childhood, such as cerebrospinal fever. In order to further explain the situation, it has been brought out that the immunity is due to a selective elimination of susceptible individuals, which, it is assumed, will be greater in densely populated centers than in communities where people are scattered about. This, however, does not account for the immunity in the cases of mumps which does not kill children. This leads the authors to fall back on the hypothesis that life in urban communities produced a general resistance to disease of which the resistance to measles, mumps, lobar pneumonia, cerebrospinal meningitis and scarlet fever are only special instances. This is doubtless

⁶ Weekly Bulletin of the Department of Health, City of New York, May 10, 1919, p. 146.

⁷ Archives of Internal Medicine, August, 1919, p. 129.

the correct explanation, and this subject has received a considerable amount of attention, such as the researches of Jobling on the influence of non-specific substances of infection, and is also commented on in this review under the head of Lessons of the War.

It is highly probable that any of the communicable diseases leaves the body in a state of heightened resistance to infections. Just how this is brought about is not perfectly clear, but might in some way be connected with persistent hyperleukocytosis. Within certain limits it has been quite definitely proved that an immunity for one disease may heighten the resistance of the individual to other infections, as in the experience with vaccination for pneumonia in the mines in South Africa. In this connection the history of epidemics furnish much that is interesting. In the 1916 epidemic of poliomyelitis, the densely populated areas of Manhattan showed a lower incidence than the less densely populated areas of Brooklyn and Queens. Indeed the freedom of the crowded New York districts from infections is a very remarkable thing. Without giving the matter much consideration, one would think that these particular districts would have an especially high mortality, whereas, as a matter of fact, Gilfoy has shown that the Russian and Austrian population of New York living under the same crowded and unhygienic conditions are most resistant to the various diseases of infancy and in consequence have a relatively low mortality. Studies made by the Prudential Life Insurance Company on measles show that where there has been a very large number of cases one year there is a very small incidence in the next year, and it was also noted that in the larger cities the extreme fluctuations were not noted, or were very much less than in the smaller ones. This periodicity has generally been explained on the ground that the susceptible persons take the disease and so become immune, leaving a relatively poor soil for the disease the following year, but an interesting fact in this connection is that the years that have a particularly bad mortality for one or two diseases will be followed by years in which the mortality from most of the infections, if not all, will be very low. This is quite in accord with the curious law formulated by Mills and Reincke, that when the mortality of any one disease is brought down there will be a diminution in the morbidity and death-rates of other diseases.

Droplet Infection and its Prevention by the Face Mask. Weaver⁸ has made another study of this important subject. This method of infection comes into play whenever an individual with pathogenic organisms in the mouth gets into contact with another individual. A very abundant droplet spray is produced by sneezing or coughing, but also ordinary talking projects a fine droplet spray over a very considerable distance. Without going into the experimental evidence, some of which was considered last year, it may be stated that gauze will filter a bacterial spray from air and its efficiency is in direct proportion to the fineness of mesh and the number of layers employed. Three layers of gauze with a mesh of forty threads or more will remove almost all bacteria-carrying droplets.

⁸ Journal of Infectious Diseases, March, 1919, p. 218.

Occasional fine droplets pass through. There is considerable clinical data available to show that gauze masks are valuable in preventing infection, just as in surgical operating theatres protection for the surgeon and his assistants and nurse is provided by the mask, the spray of infective droplets may be prevented in hospital wards. They may be used on the infected individual to prevent the contamination of the surroundings and they may also be used by the attendants.

There are several points which occur to one in connection with the mask. The first is that the mask should not lead to neglect of measures calculated to prevent transfer of infectious material by other means than by droplet sprays. Secondly, it should be noted that the masks do not cover the eyes, and while this is not desirable or necessary when the mask is used on the sick individual, a possibility of infection by getting the droplets on the mucous membranes of the eye and so into the nose and throat, should be borne in mind (see below).

When considering the use of the mask on well individuals, while it may, of course, lessen the number of infections, certainly it is not as perfect as if some means had been devised by which the eyes could also be protected. The cleanliness of the mask is another very important point. During the recent epidemic of influenza, it was not unusual to see perfectly filthy pieces of gauze being worn over long periods by individuals who seemed to think that the mask acted as a sort of amulet rather than as a filter for bacteria. Cross-infections in the hospitals can be limited by separating the beds sufficiently far apart to do away with droplet infection, and at the same time to take the usual methods of caution against transferring infectious material from one patient to another. A mask, as ordinarily constructed and worn, is rather trying, particularly in individuals who wear glasses, the moisture coming up between the face and the mask causing a film to settle on the glasses and so interfere materially with vision. This is particularly noticeable in cold weather. The masking of an entire population with gauze filters of questionable protective power and more than questionable cleanliness, as was tried in San Francisco, was a very remarkable thing in the very remarkable history of our struggle with infectious diseases. In no other field of human endeavor have as many fool things been thought of and carried into actual practice. We read the sixteenth century methods of preventing infections by wearing pieces of red coral or pieces of hoof of a goat and laugh and turn around and advocate other methods; the wearing of a dirty rag which would seem to come largely in the same class. Not that I am railing at the mask, far from it, but at the slipshod way in which it was used in most instances.

As regards the primary infection with influenza, I do not believe that the mask helped, all it did was to limit the number of secondary infections where proper technic was observed which was not often. If the disease is due to a filtrable virus and it doubtless is, a gauze mask would offer about as much protection as the old fashioned rail fence would to invasion by rats and mice.

Transmission of Infection through the Eye. The recent influenza epidemic led to a new study of the possibilities of transmission by direct

infection, particularly of prevention of infection by the use of face masks. Several observers have noted that while the mouth and nose are covered by the ordinary gauze mask, it leaves the eye exposed, and Maxcy* has a brief, but enlightening, article dealing with this subject. He calls attention to the fact that it has long been known that large numbers of organisms, such as the pneumococcus, streptococcus, influenza bacillus, and many others, may be recovered from the conjunctival sac, especially if there is obstruction to the overflow of tears. The conjunctival sac is never sterile and this has been attributed to the fact that the germ-bearing dust is being constantly received in the eye. It is also perfectly clear that droplets sprayed from the mouths of other persons during coughing, talking, etc., must be another frequent source. There is no question that many of the infectious diseases are transmitted from one person to another through the direct droplet spray. Maxcy points out that the chances of receiving the germs in the droplets into the eye is certainly very much greater during waking hours than the possibility of receiving it either in the mouth or nose. He gives some interesting figures in this connection which it is not necessary to consider.

The disposition of organisms reaching the conjunctival sac may be easily demonstrated by the use of some harmless organism, such as the *Bacillus prodigiosus*. The bacteria are swept along with the lacrimal secretion into the nose through the lacrimal duct. Maxcy found that organisms introduced into the conjunctival sac could be recovered on a nasal swab within five minutes after the instillation. They may pass through the anterior nares, especially when there is excessive secretion or when the nose is blown; or they may pass backward into the nasopharynx. He also showed that even very small doses of *Bacillus prodigiosus* when instilled into the conjunctival sac may be recovered from the nasopharynx in from fifteen to thirty minutes later. From this point the organisms may pass outward through the mouth with the sputum, or they may be carried into the larynx and reach the lower respiratory tract; or they may be carried downward into the esophagus with the swallowing movements and perish in the intestinal canal or be excreted with the feces. The latter is probably the most frequent course.

The *Bacillus prodigiosus* was recovered in the stool after having been instilled into the conjunctival sac.

To show the failure of the gauze mask as ordinarily used, observations were made on subjects wearing buttercloth masks and some of these were also instructed to hold their hands over their mouths, closing off the nostrils and holding the breath during exposure. The atomizer was directed toward the faces of the subjects from a distance of three to four feet, and the spray was applied twice, each application lasting about a second and imitating a couple of coughs. It was shown that infection of the upper respiratory tract, even in a person wearing a properly constructed mask, is an easily demonstrated fact. Maxcy suggests the use of large lenses or a pair of goggles for use by those within range

* Journal of the American Medical Association, March 1, 1919, p. 636.

of droplet spray from heavily infected individuals. The gauze mask, if properly used, is capable of preventing the infected person from spraying his environment, and it will be found of practical advantage when applied to very ill patients.

A New Nematode Infection in Man. Kophoid and White¹⁰ have described a nematode ovum in 429 cases among approximately 140,000 soldiers. The ovum measured 95 by 40.2 mikrons, with a ratio of length to diameter of 2.4 : 1. It is extraordinarily variable in size and proportions, its length ranging from 68 to 133 mikrons and its diameter from 33 to 43, and is thus the largest ovum in intestinal worms encountered in human stools. It is clearly marked by two diagnostic features that distinguish it from other nematode ova of man. The first is a broad concavity on one face usually concealed by the position of the ovum when floating on brine, so that it appears only as a flattening on the face. The other feature is the presence of two highly refractive, hyaline, bluish-green globules flattened asymmetrically at the two poles of the embryo. They are sometimes combined in one large lateral or polar globule, or are broken up into smaller pieces. The larva partakes of the color of the globules. In some instances a faint tinge of brown can be detected in optical sections of the shell. All attempts to hatch the egg in water, boneblack, at air temperatures, in the incubator at blood heat and below, and in human gastric and duodenal fluids, failed. Pending the discovery of the adult stage they intended to assign this tentatively to the species *Oxyuris incognita*. No ova of like structure have been found on examination of the feces of horses, mules, cattle, hogs, goats, or culture rats and mice from Texas.

Negroes seem to have a lighter infection than white men. The ova are found most abundantly about two months after the use of fresh salads, such as radishes and lettuce. The blood-count in every case was well within normal limits, except in one in which there was a secondary anemia. In one case the eosinophile count was a little above normal, and in 32 of 47 cases studied the large mononuclears showed a slight increase. In none of the cases was there any evidence in the history, symptoms, or physical examination pointing to an infection by intestinal parasites.

A New Gas-producing Organism. The importance of studying the bacteriology of infections accompanied with gas formation is emphasized by the fact that there are a number of organisms ordinarily associated with gas formation and for some of which a serum has been made. For example, the serum of Weinberg is made up of a mixture of antitoxin, of *B. perfringens*, *B. oedematiens*, and *Vibrio septique*. Wilson¹¹ has found another organism for which he proposes the name of *Bacillus tumefaciens*. The organism was isolated from a gunshot wound which eventually caused the death of the patient. This organism resembles the *B. welchii* and has certain specific differences. Cultures of the organism reproduced the same type of lesions in laboratory animals as were noted in the case from which the organism was isolated. Wilson

¹⁰ Journal of the American Medical Association, February 22, 1919, p. 567.

¹¹ Lancet, April 19, 1919, p. 657.

believes that this organism will differ from any of the other gas-producing ones which have been described in war wounds by the French, English, German, and American bacteriologists.

Bacillus Egens, a New Pathogenic Anaërobe. Stoddard¹² has described a bacillus which occurred in a fatal case of gas gangrene. The cultures were derived from infected muscle at a considerable distance from the wound surface, and no other anaërobes were present in the muscle. The bacillus proved markedly pathogenic for guinea-pigs, and extensive muscle lesions were produced by it from which pure cultures of the bacillus could always be obtained. Morphologically, the organism resembled the *Bacillus welchii*, but once isolated it is culturally and pathologically distinct. The organism in guinea-pigs produced very marked constitutional symptoms in addition to the local signs at the site of inoculation. The organism produced a sufficient amount of gas to cause crepitus. The cultural characteristics need not be gone into, but are given in the original article.

The Causative Agent of Seven-Day Fever. The Japanese have been making observations upon seven-day fever or what they call *nanukayami*. Ido, Ito and Wani¹³ observed, in 1916, a certain spirochete which occurred in a guinea-pig that had received an inoculation of the blood of a patient having seven-day fever. This organism resembled the *Spirocheta icterohemorrhagiæ* in form and motion, but the results of animal experiments and immunological studies show it to be a new species, and hence it was named the *Spirocheta hebdomadis*. This organism can be found in film preparations of the blood of patients, although it is not present in large numbers and may require considerable care to be demonstrated. It is also discharged in the urine, and the number of spirochetes excreted in this way is very great during convalescence. The authors believe that this organism is always present in seven-day fever and that it can be demonstrated by animal observations using guinea-pigs of light weight. Seven-day fever is found in various provinces of Japan and has been described under various names. All of the cases investigated so far have shown the presence of the organism.

Antimony Tartrate as a Cure for Bilharziasis. One of the older drugs has of recent years come into considerable prominence as an agent in killing various parasites that infect the body. In this connection the report of Christopherson¹⁴ is of interest. He has used a solution of $\frac{1}{2}$ grain of antimony tartrate and 20 minims of distilled water, and this is diluted just before injection with once or twice the same quantity of saline solution. In the beginning of the treatment, injections are made every day; later on, every other day, giving $\frac{1}{2}$ grain intravenously. The quantity given is gradually increased $\frac{1}{2}$ grain at each injection until 2 grains or sometimes $2\frac{1}{2}$ grains are injected at one time, the total quantity of antimony tartrate used in the treatment being from 20 to 30 grains. The urine of these patients is examined microscopically every day. This method has been used in the Khartoum Civil Hospital since 1917, and it has given very satisfactory results.

¹² Journal of Experimental Medicine, 1919, xxix, 187.

¹³ Ibid., 199.

¹⁴ Lancet, June 14, 1919, p. 1021.

After about 12 grains have been injected in about as many days, the ova of the parasite are found to be shrunken and shrivelled and are no longer able to hatch in water. As the injections proceed, an increasing proportion are eliminated dead. This method of treatment may be found to be of use in other parasitic diseases that have heretofore resisted the other parasitocides.

Bilharziasis in Australian Troops. The bringing together of large numbers of troops from all parts of the world must necessarily lead to an exchange of infectious diseases. Fairley¹⁵ has made analyses of 75 cases of bilharziasis occurring among the troops of the Australian Light Horse in Egypt. Clinically, the disease can be divided into two stages; an early stage that is frequently observed as occurring from four to ten weeks after infection, which Fairley calls the toxic stage, and the later period when the disease is localized, characterized on the one hand by vesical symptoms if infection is caused by the *Bilharzia hematobia*, and by intestinal symptoms if caused by *Bilharzia mansoni*. Symptoms at this stage may appear from three months to two and a half years after infection. The initial toxic stage was first described by Japanese observers, the infections with the *Bilharzia japonica*, and subsequently Flu called attention to a similar stage appearing in cases of infection by the *Bilharzia mansoni* in the West Indies.

Infection in the Australian soldiers was partly traced to bathing in a pool in July, and early in September, that is to say, within six weeks, five of them were admitted to the hospital suffering from an acute febrile disease characterized by pyrexia, rigors, frequent sweats and body pains. Four to ten days after admission there was an urticaria lasting a variable time and disappearing suddenly. The patients were all markedly emaciated, but after various periods, from ten days to five weeks, the disease apparently disappeared. During the next three months all of these five cases developed localized vesical symptoms, and the terminal spined ova were found in the urine of all five cases and also in the feces of three of them. There was an eosinophilia of 9 per cent. During the latent period, that is, between infection and localized symptoms, the patients may pass the ova and become a special danger to the community in which they live. In a case of infection with the *Bilharzia mansoni*, Fairley observed 38 cases, 33 of which had an infection with the *Bilharzia hematobia* as well. The lateral spined ova were found in the feces on microscopic examination. The patients showed localized tender points along the course of the colon, and the rectal mucosa showed the presence of small, dark red, coarsely granular patches scattered throughout the paler normal mucosa. In time, these granulations increase in size and eventually become papillomata and later a more generalized infiltration of the whole bowel will take place.

The later manifestations of this form of infection are various infections of the intestinal canal and liver. Polypoid growths in the colon may give rise to ulceration, and pericolicitis may occur. Cirrhosis of the liver is one of the complications associated with this organism. It should

¹⁵ Quarterly Journal of Medicine, July, 1919, No. 48, xii, 391,

be constantly borne in mind that soldiers, or others who have been in territories where these organisms are found may bring back the disease with them, so that if there are any suggestive symptoms, careful examination for the parasites should be made.

Botulism from Canned Asparagus. There have been since the earliest times numerous reports of sickness and death following the use of spoiled food. In many instances the disease was evidently due to bacteria introduced into the food; at other times it may be produced by toxins that have been produced by changes in the food; and in still others, disease has really nothing to do with feeding, but is some inter-current infection. It seems unquestionable that many of the so-called epidemics of food poisoning were in reality epidemics of influenza or other diseases. Various organisms have been described in connection with animal food; often the disease is due to one of the typhoid group of organisms, it may be pathogenic for the animal used for food and capable of producing grave symptoms, although perhaps not infecting man, that is to say, the organism cannot be transmitted from man to animal. Among the organisms described is the *Bacillus botulinus*, and the term botulism has been in the journals a great deal of late, particularly in English medical articles in connection with some of the cases of lethargic encephalitis. Dickson,¹⁶ a few years ago, called attention to the danger of botulism caused by vegetables canned by the cold-pack method and his studies have been printed in detail. In the foods preserved in the ordinary manner of canning, a heat sufficient to destroy the germs is ordinarily present, but sometimes this is not the case and at other times defects in the cans allow the entrance of various yeast moulds, or ordinary bacteria. The commonest form of infection is by the *Bacillus subtilis* or the *Bacillus mesentericus* groups, but neither of these seem to have any particularly injurious effect upon the human being. Both of these organisms are aerobic and if the cans are airtight, even after the food is infected, would not be expected to develop. The other groups of organisms are spore-bearing, but anaerobic and many members of this group are highly pathogenic for man and many animals. The *Bacillus botulinus* was described by van Ermengen and others, but the organisms described in the United States have not the same biological properties. There are wide variations in the thermal death point of the various strains, some of them showing a pretty marked degree of resistance to heat.

Thom, Edmonson and Giltner¹⁷ have made a study of this same subject and lay stress on the putrefaction caused by the strain of organism which they have investigated. The earlier writers described the odor as sharp or butyric, but in some foods the organism is capable of producing an offensive putrefaction. Thom and his coworkers reported 3 cases from canned asparagus. The first two were in a colored man and woman who a few hours after arising felt a choking sensation in the throat, the voice became husky, there was a sensation of weakness, and when

¹⁶ Botulism: A Clinical and Experimental Study, Monographs of the Rockefeller Institute for Medical Research, 1918, No. 8.

¹⁷ Journal of the American Medical Association, September 20, 1919, p. 907.

seen early in the afternoon, the man was unable to walk, but could understand and answered by shaking his head. The symptoms in the woman were not as severe; she was still able to talk. They were both ordered to the hospital, but the husband died before the ambulance arrived and the wife died on the way, apparently choking to death. There were 7 negroes who ate at the same meal, 5 ate asparagus, 4 of whom died within thirty-six hours. The fifth escaped. The asparagus in question was home canned, cold-pack method with single sterilization and at the time it was opened it was remarked that it smelled spoiled.

In another case the patient ate canned asparagus at 4:30 P.M. and noticed that the taste was not just right. No symptoms occurred until nine o'clock the following morning, when she had a sensation as if the tongue were swollen. By twelve o'clock there was paralysis of the glossopharyngeal nerve, the articulation was distinct, although it was an effort to talk. There was no pain, and no disturbance of vision except that objects appeared to be moved to the left side. She could walk, but veered to the left. By 3:30 in the afternoon the paralysis had progressed, there was drooping of the eyelids and a feeling of slight numbness of the right arm which showed involvement of all of the right brachial plexus. The mind was clear, there was no distress mentally or physically. By 5 o'clock the hypoglossal nerve had become affected; at eight there was complete paralysis of the tongue and what seemed to be a beginning of paralysis of the pneumogastric nerve. By 10 the respirations were slow and labored, about 12 per minute, the pulse 40, and the respiration became slower until death took place at 1:30 A.M.

Examination of some of the jars of asparagus showed that they were not very satisfactorily sealed, the contents were dark green, much disintegrated, had an offensive odor like butyric acid. Among other organisms found was a large terminal-spored bacillus resembling the *Bacillus botulinus* and cultures of this organism were exceedingly toxic to laboratory animals.

The preservation of foods for home consumption has increased very greatly during recent years, partly due to necessities and partly due to government propaganda on this subject. This has led many persons unqualified to prepare food in this manner to undertake it, with the result that a certain amount of it is spoiled. Dirty, wilted or partly rotted food is much more liable to be affected than fresh, sound clean fruits and vegetables. There is also danger from infection from dirty tables, jars and lids, sewage-polluted water and flies. Food which has spoiled, or apparently so, should be destroyed and not salvaged by fixing it into salads or minced meat or by putting it into highly seasoned pies. The toxins may be destroyed by heat, but even this leaves the spores which may develop. This should be borne in mind in case the suspected food is used to feed domestic animals, as it may start an epidemic of a very destructive character. Organisms may be in canned food without causing changes as has been demonstrated by Hunter, and Thompson,¹⁸ and Obst¹⁹ has shown that in sardine canneries in spite of

¹⁸ *Journal of Industrial and Engineering Chemistry*, 1919, ii, 657.

¹⁹ *Journal of Infectious Diseases*, February, 1919, xxiv, 158.

precautions heating the cans to 37° C. will often cause them to swell. Ordinarily, the spoiled food shows gas, and an offensive odor which would lead to its being discarded by most individuals.

There have been other studies on this subject by Nevin (*A Study of Cheese Causing Three Fatal Cases of Botulism*), Dickson and Burke,²⁰ Burke,²¹ Buckley and Shippen,²² Shippen,²³ Graham, Brueckner and Pontius,²⁴ and Graham and Bruckner.²⁵

Deer Fly Fever. In the rural population of Millard County, Utah, there occurred of recent years a disease that, according to popular belief, is started by a fly bite on some exposed part of the body. Following this, there is fever of a septic type lasting for from three to six weeks, local irritation at the site of the bite, and tenderness and inflammation of the lymph nodes, which commonly suppurate. Prostration is marked and the patient is confined to his bed. In 1919, a case terminated fatally. This led to investigation and Francis²⁶ has reported his findings. The disease is also known as *Pahvant Valley plague*. A typical case of the disease was selected and two series of guinea-pigs and rabbits inoculated, the first with the patient's blood, the second with pus from the suppurating lymph nodes. The animals developed a disease which proved fatal in a few days and examination showed caseation of the lymph nodes and small necrotic foci throughout the liver and spleen. Subsequent inoculations with lymph glands, liver, or spleen of infected animals into infected ones invariably reproduced the same lesions. Cultures on ordinary laboratory media were negative, but those made on coagulated egg yolk showed a growth of small non-motile bacilli and the disease could be reproduced in guinea-pigs by inoculating them with these organisms.

In 1911, a disease suggesting plague was observed in the ground squirrels of California, and a report made by McCoy, and this observer together with Chapin, in 1912, succeeded in growing an organism which they called the *Bacillus tularensis*. This was a small cocco-bacillus and coagulated egg yolk was found to be the proper medium. The lesions in their animals correspond to those described by Francis. In 1914, Wherry and Lamb described a case of human infection with this organism. In their cases the disease occurred in persons known to have handled wild game and at this time there was an extensive epizootic of this disease among rabbits. I reported on this subject in *PROGRESSIVE MEDICINE* for March, 1917, page 125, and also commented on the fact that Clegg had found the same organism in rabbits in California.

A Study of One Thousand Diphtheria Deaths. There have been a number of articles in the past year or so calling attention to the fact that while we have perfectly adequate means of making the diagnosis in

²⁰ *Journal of the American Medical Association*, August 17, 1918, lxxi, 518.

²¹ *Ibid.*, January 11, 1919, lxxii, 88.

²² *Journal of American Veterinary Medical Association*, 1917, 1, 809.

²³ *Archives of Internal Medicine*, March, 1919, xxiii, 346.

²⁴ *Studies in Forage Poisoning*, vol. vi, Bulletin 208, Kentucky Agricultural Experimental Station.

²⁵ *Journal of Bacteriology*, 1919, iv, 1.

²⁶ *Public Health Reports*, September 12, 1919, p. 2061.

diphtheria, also means of detecting who is susceptible and who is not and a satisfactory method of treatment if given early, there still remains a very high morbidity and mortality rate. Carey²⁷ has made a study of 100 deaths occurring in Massachusetts. The first thing that is noticeable is that while the mortality rate has been markedly reduced by the use of antitoxin, the morbidity rate has not declined. The age at which the children die in his studies corresponds to those given by the Federal Census Bureau, which states that about 65 per cent. of all cases of death from diphtheria and croup in the registration area for deaths occurred in children under five years. The Massachusetts statistics are as follows:

1 year or under	20.0 per cent.
2 years or under	13.4 "
3 " "	11.9 "
4 " "	9.8 "
5 " "	6.9 "
6 years	7.4 "
7 " "	5.5 "
8 " "	3.7 "
9 " "	2.1 "
10 " "	1.8 "
11 to 15 years	3.0 "
16 to 25 "	1.3 "
25 to 60 "	1.1 "
Age not given	12.1 "
	<hr/> 100.0 "

The difference in sex is that in the earlier groups there is a slight increase in the male deaths, while in the older ages there is an increase in the females. This is doubtless due to the fact that the older individuals acting as nurses and attendants are more liable to infection.

The spread of the disease in the schools is a factor of very considerable importance which requires future study. The greatest number of deaths, of course, is not among school children, but still the number of this class who die is yet very much greater than it should be. While most of the cases occur among the poorer classes, a considerable number were noted among the well-to-do. The greater number among the poorer classes is due to the lack of recognition, to late attendance of physicians with a late administration of antitoxin, perhaps also, to the cases of heart failure due to lack of proper restraint.

There is wide variation in the use of antitoxin. A certain number of physicians wait for the laboratory report. This is, perhaps, all right in very doubtful cases, but anyone with a reasonable clinical experience should be able to recognize most of the cases without any difficulty whatever and antitoxin should be administered immediately. In the State of Massachusetts, 7.6 per cent. of the deaths occurred in unrecognized cases, a remarkable condition of affairs in a State with a well organized health department. The number of cases found moribund on the first visit of the physician (11.8 per cent.) is strikingly high and it would seem that there were a large number of people who had a small

²⁷ Boston Medical and Surgical Journal, January 16, 1919, p. 67.

idea of their responsibility to their children. Another point of very great practical importance is the fact that there were 5.2 per cent. of sudden deaths. These deaths usually result from lack of proper nursing, which is keeping the patient at absolute rest and not allowing him to take any considerable exercise, and a certain number resulted in cases of intubation.

The variation in the use of antitoxin is extreme; in none of the 1000 cases that died was antitoxin given intravenously. The dosage varied from less than 3000 units in twenty-nine instances to as much as 22,500 units given to a child of three years. The usual dose seemed to have been from 6000 to 9000 units.

This article is an argument for the better teaching of medical students as regards the dosage and the methods of administering antitoxin, and also for the better teaching of the recognition of the disease and in methods for its prevention. In New York, the Health Department²⁸ has instituted twenty different demonstration centers where the technic of the Schick test and its interpretation is to be taught, and they are urging that all practicing physicians become acquainted with this important test.

The Schick Test and Active Immunization Against Diphtheria. In spite of the fact that we possess a satisfactory means of combating diphtheria, we have a method of determining who is susceptible and of producing a sufficiently long period of immunity in them. The morbidity and mortality rates of this disease are still very much higher than they should be if these facts were carefully taken into consideration in dealing with it. For this reason another review is being made of the Schick test and the active immunization, neither one of which have come into general use; even in a medical center of the highest type, material for making the test and conferring immunity are to be had with difficulty, if at all. If this is true in the larger urban sections, the situation in the outlying districts must, of necessity, be infinitely worse. Extensive studies have been made under the direction of Park, and the *Weekly Bulletin of the New York Health Department* for March 15, 1919, contains valuable information on this subject. The New York Health Department has also issued a pamphlet giving information on this subject, a procedure that other health departments will do well to follow. This information is as follows:

"The Schick reaction is a convenient and reliable clinical test, by which the antitoxic immunity of an individual to diphtheria can be determined. A fresh solution of diphtheria toxin is prepared for this purpose of such strength that 0.1 c.c. or 0.2 c.c. represents $\frac{1}{10}$ of the minimum lethal dose of toxin for a 250-gram guinea-pig. This amount is injected with a good syringe, preferably a 1 c.c. "Record" and a fine steel or platinum-iridium needle, *intracutaneously* on the flexor surface of the forearm or arm. A good guide for the insertion of the needle into the proper layer of the skin is to be able to see the oval opening of the needle through the superficial layers of the epidermis. A properly

²⁸ *Weekly Bulletin of the Department of Health, City of New York*, November 8, 1919, p. 353.

made injection is recognized by a distinct wheal-like elevation, which shows the prominent openings of the hair follicles. The result of the test should be read at the end of twenty-four, forty-eight, seventy-two, and ninety-six hours.

"The reaction that appears at the site of injection may be either positive, negative, pseudo, or combined positive and pseudo.

"The *positive reaction* represents the action of an irritant toxin upon tissue cells that are not protected by antitoxin. It indicates, therefore, an absence of immunity to diphtheria. A trace of redness appears slowly at the site of injection in from twelve to twenty-four hours, and usually a distinct reaction in the course of twenty-four to forty-eight hours. The reaction reaches its height on the third or fourth day, and gradually disappears, leaving a definitely circumscribed scaling area of brownish pigmentation, which persists for three to six weeks. At its height the positive reaction consists of a circumscribed area of redness and slight infiltration, which measures from 1 to 2 cm. in diameter. The degree of redness and infiltration varies to a great extent with the relative susceptibility of the individual. The positive reaction is seen in about 7 to 10 per cent. of the newborn, 30 per cent. during the first year of life, 35 decreasing to 15 per cent. between two and fourteen years, and 10 per cent. of adults.

"In the *negative reaction* the skin at the site of injection remains normal. The negative reaction definitely indicates an immunity to diphtheria if the test-toxin is of full strength, has been freshly diluted, and the injection has been made into the proper layer of the skin. A negative reaction obtained in a child that has reached the age of three years indicates that it has an immunity which is probably permanent. Of 1000 carefully observed individuals, not one developed clinical diphtheria, even though they were exposed to the disease, and some were carriers of virulent diphtheria bacilli.

"The *pseudo-reaction* represents a local anaphylactic response of the tissue cells to the protein substance of the autolyzed diphtheria bacilli, which is present in the toxic broth used for the test. Like other anaphylactic skin phenomena, the reaction is of an urticarial nature, appears early within six to eighteen hours, reaches its height in thirty-six to forty-eight hours, and disappears on the third or fourth day, leaving a poorly-defined, small area of brownish pigmentation and generally no scaling. At its height, the pseudo-reaction shows varying degrees of infiltration, and appears as a small central area of dusky redness with a second areola, which gradually shades off into the surrounding skin. The reaction may also have a rather uniform red appearance, and be two or three times the size of true reaction. A control test, made by injecting toxin heated to 75° C. for five minutes, gives a similar reaction which passes through the same clinical course. Individuals who give a pseudo-reaction only, have antitoxin and are immune to diphtheria. The false reaction is seen in relatively few of the older children, but in a much larger number of adults, in whom it is of importance to recognize and control it both by the injection of heated toxin and by observing the clinical course of the reaction.

"The *combined reaction* represents the positive and the pseudo-reaction in the same individual. The central area of redness is larger and better defined, the amount of infiltration is also more marked. The reaction is recognized by noting the evidence of a true reaction, a definitive area of scaling brownish pigmentation, after the pseudo-element has disappeared in the test. In addition, a similar, though weaker, reaction is obtained in a control test made with heated toxin. The control represents only the pseudo-reaction. The combined reaction indicates an absence of immunity to diphtheria.

"The Schick test is of practical value in determining the immunity to diphtheria of the public in general, but especially of the child population in schools, hospitals, institutions, and in homes during an outbreak of diphtheria. It will save a considerable amount of antitoxin and avoid unnecessary sensitization of more than 65 per cent. of the exposed individuals. The test is also of distinct value in the active immunization of susceptible individuals against diphtheria with mixtures of toxin-antitoxin, and in the diagnosis of clinically doubtful cases of diphtheria."

Immunity to Dysentery. This is a subject to which quite a number of workers have given a considerable amount of attention in past years. Notwithstanding the fact that it is believed that an immunity may be conferred by the subcutaneous injections of the killed organisms, the great toxicity of the material used and the frequent accidents occurring after its use have led almost to an abandonment of it. At the beginning of the war, antidysentery vaccines were tried in the Russian Army but were given up when it was discovered that the benefits conferred were more than outweighed by the bad reactions in certain cases. In England, efforts were made to palliate the discomfort of vaccination by using a sensitized vaccine after the method of Gibson. In Germany, the preference apparently has been to use a vaccine prepared by Boehncke, called *Dysbacta*, which is a combination of dysentery bacilli and the toxin and antitoxin of dysentery. This has been employed upon a large scale. In France, there has been no systematic use of an antidysentery vaccine, either in the army or in the civilian population.

Besredka,²⁹ bearing in mind the difficulties of subcutaneous vaccination in this disease, has made some studies upon the use of the vaccine given by mouth, but results were negative, inasmuch as the killed bacilli of *Shiga* given by mouth to man produce neither local nor general reaction. His observations on animals, however, notwithstanding this fact, are of considerable interest. Rabbits are susceptible to the killed bacilli when given by mouth and either are killed by the intoxication or they may survive after having certain transient changes in the intestine. The living dysentery bacillus given directly into the vein kills the rabbits, and lesions are found in the intestine. It did not seem to make any difference how the organism was introduced, it never produced a septic condition. After intravenous injection, the virus seemed to be eliminated directly by the intestinal tract. After subcutaneous injections the virus remained at first localized at the site of injection and exercised its

²⁹ *Annals de l'Institut Pasteur*, May, 1919, xxxiii, 301.

action at a distance, not setting free the endotoxin which has a definite affinity for the intestinal tract. Later, the bacilli inoculated under the skin make their way into, and are eventually eliminated by, the intestinal tract, just as is the case of that given intravenously. The killed dysentery bacilli administered by the mouth do not give rise to the formation of agglutinins except after the first ingestion. Following this, there is no further formation of agglutinins in the blood. Neither was there any evidence of preventing substances being formed in the blood, even after repeated administrations of the killed organisms by mouth. The lack of formation of antibodies in the blood does not, however, prevent an immunity being developed, and what apparently happened was a local immunity of the intestine as the rabbits treated with heated cultures of the Shiga bacillus given by mouth became definitely immune to infection with dysentery.

Lethargic Encephalitis. Last year I commented, under the heading of Epidemic Stupor in Children, on an interesting epidemic disease which has been described under various names. There have been quite a number of contributions, both in this country and abroad, and among them may be mentioned the report of the local Government Board in which MacNalty,³⁰ and others, have summarized their knowledge of the subject. The United States Public Health Service (February 21, 1919) has given a summary of the above contribution.

Bassoe³¹ has made an important contribution on this subject including a few historical notes. The earlier accounts of sleeping sickness of various kinds are more or less vague. Camerarius mentions the disease following an epidemic of grippe in Tübingen under the name of *Schlafkrankheit* in the second decade of the eighteenth century. In 1768, Lepecq de la Cloture comments on *coma somnolentum* occurring after grippe. In 1835, Ozannan, in a history of epidemic diseases, writes of epidemics of catarrhal fever with "*soporosité*" as having occurred in Germany in 1745, in Lyons in 1800, and in Milan in 1802. Hirsch, in his Handbook of Geographical and Historical Pathology, does not mention the condition. In 1875, Gayet described the lesions in an article in the *Archive de Psychologie*, his patient having had somnolence and paralysis of the eye muscles. Following the pandemic of grippe in 1889-90, the disease was described by a number of authors. Mauthner³² believed that the probable lesion was an acute hemorrhagic polioencephalitis. The disease occurred in northern Italy where it was given the name of *nona*, and a review of the literature of that time was made by Longuet.³³ The disease was described in Vienna by von Economo³⁴ in 1917, and he proposed the name used at the heading of this article. Epidemic encephalitis has also been suggested, while the use of the expression "sleeping sickness" should be avoided, inasmuch as it tends to bring confusion with the African disease due to trypanosome infec-

³⁰ The Report of an Inquiry into an Obscure Disease, Encephalitis Lethargica, published by the H. M. Stationery Office, London, N. S., 121.

³¹ Journal of the American Medical Association, April 5, 1919, p. 971.

³² Wiener klinische Wochenschrift, 1890, xl, 962.

³³ Semaine médicale, 1892, xii, 275.

³⁴ Wiener klinische Wochenschrift, July 26, 1917.

tion. The disease was also described by Sainton³⁵ who defined the disease as "a toxic, infectious, epidemic syndrome, characterized clinically by the triad lethargy, ocular palsies, and a febrile state; and anatomically by a more or less diffuse encephalitis, most marked in the gray matter of the midbrain." (Bassoe.)

Bassoe studied 11 cases, and it is curious to note that in none of these had there been any definite preceding influenza. The gross pathologic changes consisted of edema, congestion and minute hemorrhages. These latter are most numerous in the brain-stem, the base of the ganglions, and the centrum ovale. Histologically, there are accumulations of mononuclear cells around the vessels and small hemorrhages, and there is little evidence of any extensive tissue destruction or necrosis in which the disease differs from poliomyelitis. The spinal fluid is clear, sometimes under increased pressure and there is usually a slight increase in the globulin. In Bassoe's cases the cell count was less than 10 in one, 10 in one, 25 in one, and 26 in one, the mononuclears predominating.

The disease is evidently due to a specific virus which probably enters through the nasopharynx. Up to the present time the pathological investigations have not yielded any positive information. The British experience with 164 cases shows that there seems to be little doubt that there is a certain amount of fever in the early stage, though it may not be noted for several days after the onset of symptoms. A rise in temperature was not seen in all cases, but may have been overlooked. The pyrexia was generally mild, ranging from 101° to 102° F., but, in some, 104° was reached and in a few cases the temperature ran between 104° and 105°. Usually the fever lasts from two to five days, but may continue for ten days or even two weeks. It may fall suddenly or may come down gradually, and it is not infrequently followed by a period of subnormal temperature. In most cases a rather poorly defined prodromal period is noted, some catarrhal conjunctivitis usually coming on first; or with tonsillitis, simple sore-throat, or bronchial catarrh. The most marked symptom is the lethargy which may come on suddenly with a spasm or fainting spell, or, as is more often the case, the onset is gradual. The patients become stupid, somewhat dazed, sleep a great deal and are drowsy during the day. In marked cases there was tenderness of the eyeballs and pain in the eyes, blurred vision and photophobia. Diplopia is noted in a considerable number of cases and headache and vertigo were also frequent. There is an altered mental condition sometimes suggesting melancholia, sometimes a tendency to be very emotional, and in a few there is restlessness and irritability. There is a marked asthenia and when the disease is developed the patient generally lies on the back and seems unable to make any voluntary movements. The face is expressionless and there may be a definite double facial paralysis. In the severer cases the appearance has been described as that of a waxen image. Catalepsy may be present. Some of the patients are delirious, particularly at night. There are changes in the voice, which becomes nasal and monotonous, usually the patient speaks

³⁵ Presse médicale, September 23, 1918, vol. xxvi.

very slowly and the words are more or less confused, sometimes the speech is rapid and unintelligible. There may be unrhythmic movements of the face, extremities and trunk, such as are seen in chorea or affections of the thalamus. Apart from the three predominating symptoms, pyrexia, lethargy, and asthenia, the next common diagnostic sign is paralysis of the eye muscles which occurred in 75 per cent. of the British cases. Ptosis was the commonest form of this and was usually bilateral at some stage of the disease.

The prognosis is not particularly good. In the 168 British cases, there were 37 deaths.

Neal²⁶ observed the disease in New York, and Pouthier²⁷ noted a small epidemic at Camp Lee, Petersburg, Virginia; Tucker²⁸ has reported 11 cases with 2 autopsies. Perhaps the most important contribution is the study made by the Local Government Board, with the assistance of the Medical Research Committee, which was published as a monograph (Report on an Inquiry into an Obscure Disease, Encephalitis Lethargica. Local Government Board Reports on Public Health and Medical Subjects. London. (N. S. 121.) This includes a valuable clinical essay by MacNalty.²⁹

In this connection it will be well to read the review on the history of epidemic encephalomyelitis, given elsewhere in this number. It is only natural that these cases of the recent epidemic should be confused with botulism, a conditions produced by the consumption of food contaminated by the *Bacillus botulinus*, described by Van Ermengem in 1895. Cases of botulism may present symptoms not unlike those of lethargic encephalitis, that is, ophthalmoplegia, motor paralysis, and weakness of the limbs. The bacillus has not been found in association with lethargic encephalitis, and this disease is now recognized to be due to a specific virus which probably finds entrance through the nasopharynx and resembles the virus of poliomyelitis in that each has a special affinity for the nervous system, although for different areas in animals. The lesions in botulism are not inflammatory, although they affect the same portions of the nervous system.

Marinesco, who has made a study of this subject, is positive that the lesions of lethargic encephalitis are inflammatory in nature, but in MacNalty's review of the symptomatology he finds the malady as a general infectious disease characterized by manifestations originating in the central nervous system, in which the most frequent and characteristic are progressive lethargy or stupor and a lesion in, or about, the nuclei of the third pair of cranial nerves. His report is based on a study of some 164 cases. The disease is a febrile affection and, while fever has not always been noted, it seems certain that it is practically always present in the early stages; as a rule, it varies between 101° and 102° F., but temperatures up to 104° and 105° F. are not uncommon. The average duration is from two to five days, but in some instances the pyrexia continues for ten or even fourteen days. There is a prodromal

²⁶ Journal of the American Medical Association, March 8, 1919, p. 714.

²⁷ Ibid., p. 715.

²⁸ Ibid.

²⁹ British Medical Journal, January 11, 1919, p. 45.

period noted in some cases, but it is not very well defined. The disease generally begins with simple catarrhal conjunctivitis, in some with a tonsillitis, simple sore-throat, or bronchial catarrh, but the most prominent symptom in 80 per cent. in the early stage is a progressive lethargy. Occasionally it begins with a fainting attack or fit, but usually the onset was gradual. The patient sleeps a great deal, is drowsy during the day and becomes dazed or stupid. In the more marked cases there is heaviness of the eyelids, pain in the eyes, blurred vision and photophobia. Headache and giddiness are common, and diplopia, while not always present, is a very suggestive symptom. In some instances, in spite of the mental depression, there was a highly emotional state which might be mistaken for hysteria, but in others melancholia may be present.

MacNalty divides the disease into seven different types, as follows: (a) a clinical affection of the third pair of nerves; (b) affections of the brain-stem and bulb; (c) affections of the long tracts; (d) the ataxic type; (e) affections of the cerebral cortex; (f) cases with evidence of spinal cord involvement; and (g) the polyneuritic type in which affection of the peripheral nerves is suspected. The duration of the disease is variable. It may only keep up for two or three days, more often two to five weeks, and even as long as eight weeks.

The prognosis is not always as bad as the appearance of the patient would suggest. In a total of 168 cases, 37 deaths were reported.

The diagnosis is not very difficult, although the disease may be mistaken for hysteria, for poliomyelitis, for infectious polyneuritis or, perhaps, more often for tuberculous meningitis. From this and cerebrospinal fever the diagnosis can be made by lumbar puncture, inasmuch as the cerebrospinal fluid in lethargic encephalitis is changed but little if at all in the majority of cases.

The question of the identity of this disease and poliomyelitis is still one that is to be settled, but MacNalty suggests that the relation between them may be perhaps comparable to that known to exist between typhoid and paratyphoid.

Wegeforth and Ayer⁴⁰ have made a report of 8 cases, with pathologic examination of 4. The most important part of their report is the fact that they carried out inoculation observations with fresh material into monkeys, rabbits, guinea-pigs and mice. All of these observations were negative, but this might possibly have been due to the fact that the spinal cord used did not show any marked changes, and that the patient from whom it was taken died late (twenty-ninth day) of the disease.

Using the technic devised by Noguchi for the cultivation of spirochetes, Loewe and Strauss⁴¹ have been able to demonstrate that the nasopharyngeal mucous membrane of persons suffering with epidemic encephalitis contained a virus which, when injected into monkeys and rabbits, was capable of producing typical lesions similar to those found in the brain in human cases. The nasal washings and the nasopharyngeal mucous membrane have both been used, the material having first been passed

⁴⁰ Journal of the American Medical Association, July 5, 1919, p. 5.

⁴¹ New York Medical Journal, May 3, 1919, p. 772; Journal of the American Medical Association, October 4, 1919, p. 1056.

through a Berkefeld filter V. and N. In the cultures, the growth was noted from the fifth to the seventh day, a clouding occurring in the region of the kidney tissue and extending rapidly upward. Smears from these, properly stained, showed small diplo-bodies occurring singly, in diplo-forms, chains or clumps. They are not motile and the reaction of the Gram stain depends largely upon the medium used and the age of the individual culture. Young cultures and those grown on solid medium are mostly gram-positive, and those grown on fluid media and older cultures tend at times to be gram-negative. The general appearance of the organism corresponds to that described by Flexner and Noguchi in poliomyelitis, but it differs in results obtained with animals, and particularly in the susceptibility of rabbits to this organism. Up to the time of the report the organism had been carried to the twelfth generation. It was also recovered from 50 per cent. glycerinated filtrate of human nasopharyngeal mucous membrane kept on ice for four months. In cultures, the organism has remained alive for as long as six months. Bradford and his coworkers have made similar observations.

Acute Encephalomyelitis. In the late summer of the years 1917 and 1918, in certain parts of Australia there was an epidemic which has been described under the above name by Cleland and Campbell,⁴² although the disease suggested the meningitic form of acute poliomyelitis and also, in some cases, encephalitis lethargica. The authors believe that they are dealing with a separate and distinct infection. The disease was an acute and very severe illness, usually coming on with an abrupt onset and was fatal in 70 per cent. of the cases. While the disease was very frequent in children, it also appeared in adults. The chief characteristics related to the cerebrospinal system. There were convulsions, rigidity, increased reflexes, dulling of the mentality and, subsequently, loss of consciousness. This was accompanied by fever, gastric and other disturbances, terminating in coma and death in a few hours; if recovery took place, it was rapid and usually complete, but in a few instances a flaccid paralysis, or mental disorder persisted.

Sixteen cases were studied histologically and revealed a diffuse acute encephalomyelitis characterized by vascular engorgement, a lymphocyte-like cell infection around the veins, infiltration of the tissues of smaller cells, and a tendency to capillary hemorrhage. It affected the gray substance more than the white on account of the difference in the vascular supply, but the destruction was not as great as that seen in poliomyelitis. By intracerebral inoculations of emulsions of portions of the nervous system, the disease has been transferred from human beings to the monkey, from monkey to monkey in series, and from monkey to sheep, back from sheep to monkey, and, finally, back to monkey from monkey, from monkey to one horse and one calf; all of which results were confirmed by histological examination, showing changes corresponding with those found in man.

In monkeys, the disease was very fatal; in sheep, not so much so,

⁴² British Medical Journal, May 31, 1919, p. 663.

some seeming to show a certain degree of immunity. The horse and calf died with convulsions.

Hookworm Disease. The fifth annual report of the International Health Board of the Rockefeller Foundation contains, in addition to other things, an appendix that has much valuable information upon this subject. Their studies have led to a number of important conclusions and it is believed that the disease exists wherever the larvæ of the hookworm find favorable conditions of shade, moisture and temperature for their propagation and growth. Therefore the disease is found between the parallels of 36° north and 30° south. The larvæ develop best at a temperature of 25 to 35° C., while below 22° few develop. In addition to heat, moisture is an important contributing factor in the spread of the disease and the result can be predicted by consulting the annual rainfall. If this is less than ninety inches the infection will be found to be light, while if it is more than ninety the infected area will suffer correspondingly. The disease is one that is usually widespread within the infected areas. In some places the rate of infection is extraordinary. Thus in India in some regions the population was found to be infected to 98 to 99.8 per cent. for workers, and in some parts of the country the infection is from 80 to 100 per cent. In Sao Paulo, in Brazil, farm workers suffered to the point of 77.3 per cent., brick makers and other similar occupations 52.5 per cent., whereas clerical workers and salesmen were affected only to the point of 42.4 per cent.

The severity of infection varies somewhat in different races and in the studies based on examinations from 1914 to the end of 1918, all the races had a combined rate infection of 62 per cent. The white race enjoyed a comparative immunity, showing 40 per cent.; the black race came next with 59 per cent., the yellow races 77 per cent., the brown races of Central America, 70 per cent.; the brown races of the east, 83 per cent., and the red races, 81 per cent. Where the disease is very prevalent, the percentage of cures is less than where the infection is light. For example, in a district with 95 per cent. of the population infected, there were less than 19 per cent. of cures by two treatments, while in another district in which the general infection was but 26 per cent., 76 per cent. of these were cured by two treatments.

The severity of the infection, it has been found, may be estimated by counting the worms expelled after giving a vermifuge. The number varies greatly, sometimes only a few being discharged, 35, while in others the average may run between 200 and 300, while sometimes as many as 4000 worms may be recovered from a single patient.

As a rule, the disease is more common in agricultural sections than it is in the mountains. There is in general a definite relationship between the number of worms found and the amount of blood loss and anemia. Although this may be offset by abundant food and rest, the loss of blood is a constant tax on the vital powers. Usually in infected regions there are other causes for anemia, such as malaria and underfeeding, not to mention many other diseases that lessen the vitality. The effect of the worms, as evidenced by the anemia, shows that in children a greater

degree of anemia may be produced by a small number of worms than in women, and the anemia in women from the same number is greater than it is in men. The increase in hemoglobin following treatment is quite remarkable. The figures vary in different parts of the world, but one example may be cited in which the hemoglobin of persons just cured was 63.3 per cent., while two years later, among the persons remaining uninfected, it was 76.8 per cent. There was also a gain in weight in the individuals who were cured. The hookworm disease lowers the resistance so that, in heavily infected districts, the morbidity and mortality rates are highest among infected individuals and the reduction of the morbidity to the hookworm reduces the general morbidity, another demonstration of the Mills-Reincke phenomenon.

The effect on the birth-rate is considerable. After becoming cured, many women became pregnant who had not borne children for years, and if menstruation had stopped, it usually became regular.

One of the most striking features of the hookworm infection is the mental retardation. The longer the infection has persisted in a child, the greater is the amount of backwardness. There is considerable variation, the lightly infected cases showing less than the severe ones; in some instances as much as five years' retardation was recorded.

There are several methods of examining the stools. In addition to the plain smear and centrifuge methods, special technics may be used to demonstrate infection in cases which escaped detection by the other methods. Two have been especially recommended; one the glycerin-salt, and the other the brine-flotation-loop method. The former was developed by M. A. Barbour, in his work in the Malay States, and his work is supposed to have been very satisfactory.

Process of Examining by Glycerin-Salt Method. "In using the glycerin-salt technic, a diluting fluid composed of equal parts of a saturated solution of magnesium sulphate and glycerin is prepared. This fluid is dropped from a large dropping-bottle into the small tin box which contains the specimen. The fecal mass is thoroughly stirred and broken up with a toothpick, which releases the ova and causes them to rise to the surface. The upper part of the fluid in each container is poured upon a two-by-three-inch glass microscope slide which has been rimmed with paraffin or grease, and the surface of the slide is searched for eggs. The entire contents of a container may be examined by preparing three or four of these slides. The process regularly followed is to examine two slides before, and two after, centrifuging the specimen. The glycerin-salt diluting fluid is used in preparing all four of the slides, including those made before, as well as after, centrifuging.

"The number of ova brought upon the slide by the glycerin-salt method is so greatly increased that the eggs may be much more easily found than when the plain method is used. This reduces the number of specimens that have to be run through the more time-consuming process of centrifuging, and results in a great saving of time."

Making a per cent. of various methods they found that by the plain slide method 40.7 per cent. were found positive, by the centrifuge, 55.5 per cent., and by the glycerin-salt method, 70.3 per cent.

The *brine flotation-loop method* was the result of work done by Kofoid and Barber⁴³ using the following technic: "A large fecal sample is mixed thoroughly in concentrated brine in a paraffin paper container of from 50 to 75 mils (two to three ounces) capacity. The coarse float is forced below the surface by means of a disk of No. 9 steel wool and the container is allowed to stand one hour for the ova to ascend. The surface film is then wiped off with wire loops one-half inch in diameter and examined on a slide without a cover-glass. The ova of hookworm and of other parasites are floated up by the brine into the surface layer of the pool without distortion or noticeable change in appearance.

"The great advantage of this method is believed to lie in its easy utilization of large samples. With containers of sufficient size, receptacles for mixing the entire stool may be employed. This eliminates the element of random sampling except insofar as this may be due to irregular egg-laying by the female worms or to an unequal discharge of eggs in successive stools. It insures also a sufficient number of ova to make detection possible in light infections which may be overlooked by other methods using smaller samples. It is for this reason a more accurate means of diagnosis. In addition, it is reported to be about 50 per cent. more rapid than the centrifuge methods."

The treatment that has been employed most often is by the oil of chenopodium, a special method of using which I have commented upon in this review. Of course, the whole problem consists not only of curing the patients, but of developing methods that will prevent infection and reinfection. This means proper disposal of sewage, which is in almost all hookworm regions carried out in a very primitive manner, if at all, and has led to the study of soil sanitation and the results obtained in certain sections where work has been done along this line the ultimate outcome ought to be quite satisfactory, although combating a disease like hookworm means constant and unremitting zeal.

The Intra-intestinal Tube in the Treatment of Hookworm Infection. An interesting modification of the technic in treating patients suffering with hookworm is made by Kantor.⁴⁴ Bearing in mind that the first portion of the jejunum is the part of the intestine ordinarily inhabited by the hookworm, with extension along the intestine in both directions in the severer cases, he has suggested the use of the Rehfuß tube in applying a maximum dose of whatever drug is used for eradicating the worms. His observations are based on more than 250 treatments, and he believes that better results would be obtained with this method, inasmuch as the vermifuge nowadays usually used, that is, oil of chenopodium, given in capsules are not under the control of the physician and the dose may be liberated at some undesirable point. It also has the advantage that it allows the entire dose to be given at one time. The procedure the evening before the treatment consists in giving the patient a light supper, chiefly rice and milk, without catharsis. On the following morning, the duodenal tube is swallowed on a fasting stomach and the patient is kept on his right side until the bucket has passed the pylorus. The exact

⁴³ Journal of the American Medical Association, No. 19, lxxi, 1557.

⁴⁴ Ibid., October 18, 1919, p. 1181.

time that the intestine is entered can be determined by testing with Congo paper. Material from the stomach is generally positive with the Congo paper, whereas if golden-yellow, viscid bile is withdrawn, the reaction is negative. From 2 to 3 c.c. have been used at a dose in army practice. Six minutes is allowed for the diffusion of the oil throughout the worm-bearing area, and, at the expiration of this period, two to three ounces of a warmed saturated solution of magnesium sulphate is given in the same manner. The idea of this flush is to remove the drug quickly from the very highly absorptive small intestine in order that undue toxic effect may be avoided. The use of this method will also permit very much larger doses of drugs than are ordinarily used. After the salts are given, the tube is removed, when the treatment is complete.

Usually there is a certain amount of systemic action from the oil, beginning some twenty minutes after its administration by the tube. There is a sensation of tingling and numbness throughout the body, particularly in the palms and the soles. The discomfort is transient and seldom exceeds four or five hours. Occasionally there may be vomiting, but this is more apt to be due to the removal of the tube. Tinnitus aurium is complained of by some patients and there are a few who had violent spasmodic, non-productive coughing, but in all of these, with one exception, an existing or recent disorder of the respiratory system had been present. Occasionally there is a slight excitation not unlike that produced by alcohol. This has occurred in a very small percentage of cases. In a few others there was a lethargic state and considerable prostration, with sleep until the morning following the treatment. In one instance, forty minutes after the administration of the oil, there was a sudden, severe collapse with almost imperceptible pulse and cold perspiration. This was relieved by external application of heat and active stimulation. There was retention of urine for the next thirty-six hours. One or two patients complained of increased frequency of micturition, with pain in the back.

Unfortunately, Kantor does not give a summary of the end-results in these cases, and so one is unable to make a comparison with his method of treatment and the older method of giving the oil by mouth. It would seem, however, that this is a very definite improvement and a step toward greater efficiency in therapeutics in general.

The Spirochete of Infectious Jaundice in House Rats. Of recent years the subject of infectious jaundice has come in for a considerable amount of investigation. This was greatly increased in 1914 by the announcement of Inada and Ito of the discovery of a spirochete in the liver of a guinea-pig which developed jaundice and died as the result of an inoculation from a case of infectious jaundice. This organism was found to be the etiological factor of Weil's disease, and Inada named it the Spirochete icterohemorrhagia. More recently, Noguchi, believing it to be a new genus, and unlike the previously described spirochete, suggested the name of leptospira. In 1915, Miyajima found similar organisms in kidneys of field mice and later on found some which when injected into guinea-pigs produced fever, hemorrhage and, after a number of generations, icterus. As the immune serum of the spirochete of Inada was

capable of destroying these organisms, he concluded that the organisms in question were identical. In 1917, Ido, and his coworkers, found the organism in two cases of jaundice following the bite of rats and were thus led to believe that rodents play an important part in the transmission of the disease. These same observers made a study of the house and roof rats in the city of Fukuoka and found that a considerable number of them contained the organisms. They also produced the disease in guinea-pigs by allowing the rat to bite the pigs and once out of fifty times got positive results. No spirochete could, however, be demonstrated in the mouth of the rat. Subsequently these results have been confirmed by English and other workers, and the organisms have been found in field rats. In the United States, Noguchi has found them in New York City; they have also been found in Nashville, Washington, and, in fact, in every place in which a systematic study has been made.

Otteraeh⁴⁶ made a study of the house rats captured in the basement of a medical college in the city of Chicago. Out of the 30 animals examined only 2 were found to be infected, the organism being demonstrated in material from the mouth and tissue from the kidney.

- **Antimony Tartrate in Kala-azar.** I have commented upon this subject several times, but it may be well to call attention to a further contribution by Low,⁴⁶ in which he gives the details of a case treated in England in which the patient, dying of influenza just at the termination of his treatment, gave an opportunity to determine whether or not a complete sterilization of his *Leishmania donovani* had taken place.

He believes, from this and from other evidence of his own and of other observers, that the antimony tartrate is a specific in the Leishmanian infections. He calls attention to a very important fact, namely, that in large doses over prolonged periods antimony produces fatty changes in the liver and kidneys which may seriously damage the resisting powers of the patient and may even cause death, as in the case reported by Breinl and Priestley.⁴⁷ It should, therefore, not be given over longer periods than necessary, and it is important that some test should be devised which will indicate when the infection of kala-azar has disappeared. In all cases in which the drug is given the patient should be confined to bed on the day of the injection and kept there till the day after, being carefully watched throughout the course and any indications of gastric or constitutional disturbances at once contra-indicating further injections. Not more than two injections a week should be given, and the drug should not be too concentrated.

In the case which Low reports, some idea of the dosage may be obtained from the fact that the patient was under treatment from October 18, to February 10, during which time he was given thirty-two injections at the rate of two a week, starting with one-quarter of a grain given intravenously, increasing to one-half and then to one grain, and then to a grain and a half, and two grains, finally reaching two and a half grains at the fourteenth dose. This was continued without any further increase in the size of the dose.

⁴⁶ *Journal of Infectious Diseases*, May, 1919, p. 485.

⁴⁶ *British Medical Journal*, June 7, 1919, p. 702.

⁴⁷ *Journal of Tropical Medicine and Hygiene*, February 15, 1918, p. 38.

Low⁴⁸ has another contribution on the subject of using antimony tartrate in the treatment of skin infections by the *Leishmania americana*. He reports one case in which, at the beginning of the treatment, about an inch of the right ear was gone and there were still signs that the disease existed and was spreading, but there were no signs of involvement of the mucous membranes of the nose or mouth. The Wassermann reaction was negative. The same dosage of the drug was again used, it being dissolved in two ounces of normal salt solution, sterilized, and run into a vein at as near body temperature as possible. The effect upon the lesion was striking, apparently a perfect cure taking place.

Rogers⁴⁹ has made a short report on the use of *colloid antimony sulphide* intravenously in kala-azar. He was led to use this on account of certain dangers accompanying the use of tartar emetic intravenously. The toxicity of this solution is remarkably low as compared with tartar emetic or sodium antimony tartrate. It is prepared by saturating a 1:200 solution of tartar emetic with sulphuretted hydrogen. The colorless liquid becomes deep red, but does not throw down any precipitate. The solution is then dialyzed against distilled water to remove the potassium bitartrate. It is then tested and diluted to a strength of 1 in 500. Glucose is added to make the solution isotonic to the blood, gum arabic to make it more stable and phenol to preserve it. The final solution should contain 5 per cent. of glucose, and 0.5 per cent. each of gum and phenol.

The temperature reactions were less frequent and severe, there were no toxic symptoms following the injections. The gain in weight was rapid, much more so than when the antimony tartrates were used. The spleen diminished in size, and the solution was excreted through the kidney more slowly than the other preparations.

The amount of tartar emetic and sodium antimony tartrate used per case was respectively 155 and 160 cg., while with colloid antimony sulphide the amount used was 20.8 cg., which is equivalent to 41.6 g. of the tartrates, but still contains approximately one quarter the amount of antimony in the latter salts.

Wilson also suggests that this may be well worth trying in sleeping sickness. Another suggestion consists in using antimony tartrate by mouth in young children. In adults it may be administered in one grain or one-half grain pills, beginning with one grain three times each day and increasing the dose half a grain each day as long as tolerated. In this manner twelve and a half grains could be used in a twelve-year-old boy. The results were not very satisfactory in the older individuals, but in the trial on young children it seemed to give better results than simply using the inunctions of metallic antimony in lanolin.

Malaria. THE COST OF MALARIA. There is perhaps no better way of impressing the ravages of disease in any given district than by showing the population the economic loss sustained. Gray⁵⁰ has made a study of the cases of malaria in the Anderson-Cottonwood Irrigation District,

⁴⁸ British Medical Journal, April 19, 1919, p. 479.

⁴⁹ Lancet, March 29, 1919, p. 505.

⁵⁰ Journal of the American Medical Association, May 24, 1919, p. 1533.

in Shasta County, California. He made a study of the number of families, the number in each family, the number of cases of malaria, the cost of medicines, the cost of medical services, and the labor loss. He found that approximately one-half of the population had malaria in 1918. The least malaria appeared where there was the least irrigation. The three items—medicine, medical services and labor lost—averaged \$31.70 per family, \$14.05 per person sick, and \$7.66 per person. In the most intensely infected region this was increased to an average of \$75.10 per family, \$27.20 per person sick, and \$17.80 per person. The total cost for the entire population of the district was \$10,400. This study did not take into account the deaths, or the labor loss among casual laborers, or losses caused by inability to handle crops at the proper time on account of malarial attacks; nor does it consider the losses on forced sales of property or those due to vacant property, or those due to depreciation of property.

In various control measures, it was estimated that \$22,400 would have to be spent the first year; \$5000 in the second year, and \$3800 in subsequent years. In the first year's estimate, \$12,000 would have to be expended for agricultural drainage and would not be definitely charged up against malaria. These figures show, and the experience of other districts prove, that it is economically cheaper to control malaria than it is to suffer it.

THE CAUSE OF ANEMIA IN MALARIA. The early development of more or less severe anemia is characteristic of malarial infections and this is most marked in the æstivo-autumnal variety. The explanation of this anemia is given by Lawson.⁵¹ She found that each parasite by migrating from one cell to another causes the destruction of several red corpuscles. The reduction of hemoglobin which is out of proportion to the loss of red corpuscles is explained by the fact that there is always a loss of hemoglobin in the surviving corpuscles due to parasitic action. There are at all times a certain number of parasites attached to corpuscles which are partially decolorized by their action. Thus, when a red count and hemoglobin estimate are made, each partially decolorized corpuscle counts as a corpuscle, but there is a partial loss of hemoglobin in these which goes into the total loss.

The Serum Therapy of Malta Fever. Sargent and Lhéritier⁵² have contributed an article on this subject. The serums which they used came from horses and was produced in one of three ways: either by injecting living microbes into the veins, living and dead microbes under the skin, or lastly, by an endotoxin obtained by macerating the dead organisms and injecting this under the skin. The serum obtained by the subcutaneous injection of the horse with the living or dead microbes, but not macerated, was shown to be without value. Good results, however, were obtained in many cases with the horse serum obtained after injecting the living organisms into the veins or after the subcutaneous injection of the endotoxin. The last procedure has the advantage that it is not dangerous for the individuals who care for the

⁵¹ *Journal of Experimental Medicine*, 1919, xxix, 361.

⁵² *Annales de l'Institut Pasteur*, May, 1919, xxiii, 336.

horses. The dose of the serum, which apparently has not been standardized, is 50 c.c. given on each of three successive days. The good effects of the serum were a disappearance of the pain and, several days later, a fall in the fever. The serum seemed to be particularly efficacious in the chronic painful forms of the disease.

Influenza. The epidemic of influenza left such an impression on both the lay and professional mind of every country that it visited that no special comment need be made in this direction. If one attempts to get an idea from the medical journals and from various studies of what the disease is, they will find a Herculean task awaiting them. In the first place, the number of contributions is so enormous that the mere titles would perhaps fill the volume in which this review is printed. In the second place, a large number of these reports were made by observers not competent to pass upon clinical evidence or upon the results of therapeutic or etiologic findings, so that the first task is to weed out the undesirable. This leaves us still with a very enormous amount of material, difficult to comprehend, composed as it is of statements, made with the air of authority, by competent workers; opinions many times diametrically opposite and which necessarily do not represent the whole truth, even though they represent a part of it. In order to make the review which follows a little more clear, your attention is asked to the opinion of the reviewer, who withholds the right to modify his views later should further observations make it necessary.

In the next place, we are confronted with the fact that there is somewhere, perhaps as Flexner thinks, on the eastern borders of Russia, a focus from which there has spread over the world a very remarkable plague and this is merely a repetition of various other excursions of this same frightful disease. Apparently, it starts from the region where it is endemic, the region in which, if the world is to be freed from it, the work of prevention must be begun. This disease travels with the rapidity of human travel. What is the cause of this epidemic and why should it leave its home? Of the second part of the question, I do not think we are in a position to say much. We know that all endemic diseases have a tendency to travel from time to time. What starts them on their way is still a moot question, but there must be a suitable soil for the growth of the organisms otherwise they must needs remain at home. This soil is provided either by the growth of a population that has never had the disease, the growth of another generation, so that we have an epidemic practically once every generation. The widest spread epidemics cannot be explained wholly on this basis. As to the cause of the disease, that is, its microbic origin, we are perhaps in possession of more certain data but whether or not our opinion today will remain true tomorrow must await another epidemic with a confirmation of the findings of the observers of today who will be present to quote it, or perhaps the Rockefeller Foundation will send an expedition into the home of this disease and there try to confirm or disprove what has been done by the workers in the past year.

In practically every country in which the disease has been studied, some observers have been able to isolate a filtrable virus, that is, an

organism sufficiently small, at least in one stage of its existence, to pass through the pores of the Berkefeld filter ordinarily used in the laboratories. Such a virus was described first perhaps by Gibson, Bowman and Connor,⁵³ who were influenced by the work of Foster on the etiology of common colds. We must also consider the work of Bradford, Bashford and Wilson⁵⁴ in England; that of Nicolle and Lebailly⁵⁵ in France; Cunha, Magalhaes and Fonseca in Brazil; and of Skakami, Yamanouchi and Iwashima in Japan. Perhaps the very first observation was made in Germany by Selter and Koenigsburg.⁵⁶ The point of priority in a work of this kind is not very important, for all the workers are working independently using similar methods, but uninfluenced and perhaps totally ignorant of the work of the others. These observers have apparently proved that there is in connection with this disease a filterable virus, but before going on it is only fair to note that competent observers, such as Rosenau and Keegan,⁵⁷ and Nuzum,⁵⁸ and others, were unable to isolate this virus. Assuming, however, that a special virus does exist, it apparently enters the body, and produces a highly toxic substance which causes a tremendous lowering of the resistance to bacterial infection. Bacterial infections practically always follow in the individual affected with influenza. The number and variety of organisms described is legion, but for the most part they consist of organisms that are well known as being pathogenic at times and normal inhabitants of the mouth, particularly of city dwellers, or to the distinctly pathogenic organisms which may at times produce disease. These secondary invaders consist chiefly of the influenza bacillus of Pfeiffer, non-hemolytic streptococci, pneumococci, the hemolytic streptococci, and other organisms.

Lucke, Wight and Kime found the influenza bacillus in a very high percentage of cases and they consider it, if not the prime cause, at least the most important indicator of epidemic influenza. Its appearance with the epidemic and its relative absence prior thereto they believe strongly strengthens the assumption of its pathogenic role.

As the patient lived longer as the epidemic progressed, bacterial agents, known to be the cause of respiratory tract diseases in the locality in which the studies were made, appeared as secondary invaders and so modified the bacterial findings and the anatomic changes. Notable among these were the non-hemolytic streptococcus and the pneumococcus. When there are a number of secondary invaders, death is more liable to result than when the infection was confined chiefly to one. Later in the epidemic the hemolytic streptococcus appeared as a territory invader, crowding out the secondary ones and toward the end of the epidemic the staphylococcus and *Micrococcus catarrhalis* were observed.

Flexner,⁵⁹ in his presidential address before the Tenth Congress of

⁵³ British Medical Journal, December 14, 1918, p. 645; *ibid.*, March, 1919, p. 331.

⁵⁴ *Ibid.*, February 1, 1919.

⁵⁵ Rivière, *Compt. rend. Acad. de Sc.*, 1918, clxvii, 606.

⁵⁶ *Deutsch. med. Wehnschr.*, 1917, xliii, 932.

⁵⁷ Journal of the American Medical Association, September 28, 1918, p. 1051; Public Health Reports, 1919, No. 33, vol. xxxiv.

⁵⁸ *Ibid.*, November 9, 1918, p. 1562.

⁵⁹ *Ibid.*, September 27, 1919, p. 949.

American Physicians and Surgeons, spoke upon Epidemiology and Recent Epidemics. He pointed out a very valuable lesson in the prevention of disease, one which he believed was made possible through the results in the work in combating yellow fever. There is a serious and apparently very successful campaign in eradicating this disease from the earth. This is being done by searching out the endemic points and cleaning them up. Havana and Panama have been rendered free from the disease and now Guayaquil has been attacked. If a disease such as yellow fever can be eradicated, Flexner believes that it will also be possible to eradicate other diseases, such as poliomyelitis and influenza by searching for the endemic foci and eradicating the disease from them. Certain infectious diseases will remain at home for periods of time, then suddenly, for some reason, start out to seek new countries and fresh material, and devastating epidemics are the result.

It seems highly probable that the home of poliomyelitis is somewhere on the shores of the Baltic, doubtless to the north of it, while influenza seems to have its origin in eastern Russia and Turkestan. The spread of influenza, when studied geographically, shows that in the East it travels from place to place with the pace of a caravan, in Europe and America with the speed of an express train, and in the world at large with the rapidity of an ocean liner; and, as Flexner adds, if one project forward the outcome of the means of intercommunication of the near future, the next epidemic will extend with the swiftness of an airship.

INFLUENZA AND THE PLAGUE. Without doubt some of the plagues described in the history of medicine were epidemics of influenza, but it should be borne in mind that the disease is perfectly distinct in a number of different ways from the so-called bubonic plague. There have been a lot of lay articles on this subject and some in the medical journals. Among these latter is one by Lee,⁶⁰ a Surgeon Major in the Chinese Army. The differences are first and most conclusively along bacteriologic lines. Epidemiologically, the epidemic of plague pneumonia in China in 1909, and again in 1919, was definitely disseminated along the highways and through the passes of the great wall, finally traffic being stopped to prevent the spread. While the 1918 epidemic of influenza occurred in all the cities along the railways and coast and also in the far interior, away from the general traffic, the clinical differences are that the plague pneumonia is shorter in its course and more intense, recovery being the exception. Lee gives the recovery of only 2 patients in 72,000 cases. The absence of bubonic feature is also striking. The distribution was somewhat different, plague pneumonia being almost entirely among the laboring classes, while influenza pneumonia attacked all of the population. The infectivity is also very different. In plague pneumonia, where direct contact is necessary for infection, proper precautions furnished the necessary protection, which is not the case with influenza. The other type of the disease is, of course, transmitted by the rat flea.

The discoloration of the patients dying with either disease also had

⁶⁰ New York Medical Journal, September 6, 1919, p. 401.

led to some discussion, but this discoloration is commonly seen in corpses of those who have died of any disease in which the infecting organism produces hemolysis.

THE FILTRABLE VIRUS OF INFLUENZA. Bradford, Bashford and Wilson⁶¹ have reported on some observations made on the British Expeditionary Force, and Clayton has added an appendix of clinical notes on cases of influenza from which the filtrable virus was recovered. These observations are exceedingly interesting, viewed in the light of the ideas of Crookshank, noted elsewhere in this review, and also the studies made on the virus of poliomyelitis.

The epidemic occurred in the troops in the autumn of 1918 and the early spring of 1919. Both these epidemics were characterized by the frequency and severity of the pulmonary lesions. In many instances these were complications in the true sense of the word in that they were due to secondary infections, but in other cases they were thought to be due to the pathogenic action of the filter-passing virus as isolated by Bradford and his associates. The pulmonary lesions were bronchitis, pneumonia, hemorrhage, edema of the lung and pleural effusion. There were very few complications relating either to the nervous system or the gastro-intestinal tract, and very few cases of influenza meningitis or even of meningismus have been seen, but the filter-passing virus has been recovered from the cerebrospinal fluid in the only case of meningitis that came under observation. In some instances a few days after the beginning of the attack, a moderate degree of jaundice was noted and here also the filter-passing organism was recovered from the blood. This is of interest in view of the marked hepatic lesions observed in the animals inoculated with the culture and also to the fact that the organism is present in large numbers in the bile of experimental animals and that this could be used as a means of inoculation in passage experiments. There was also, in some instances, a moderate degree of nephritis, and in these the filter-passing organism was recovered from the urine, but it was never found in the urine of influenza cases when no nephritis was present. It was noted, too, that there was a marked tendency to hemorrhage in the more severe forms of influenza, in some cases the hemorrhage taking place in the voluntary muscles and more especially the rectus abdominus, and in others from the respiratory tract. The sputum in these latter cases may be rather copious and watery, or scanty and glutinous, and it contains varying quantities of bright red blood. This sputum is totally different in appearance from the well-known rusty sputum of pneumonia and is very characteristic of some of the most severe and fulminating cases of influenza.

Bradford and his associates have succeeded in isolating a filtrable virus from a series of carefully controlled cases, and thought they obtained the organism in pure culture (see below the observation of Arkwright), and have reproduced in experimental animals lesions of a character similar to those found in the disease in man. The organism is found in such animals, and can be recovered from its tissues. In the

⁶¹ Quarterly Journal of Medicine, April, 1919, No. 47, xii, 259.

animals inoculated, the changes observed were in the heart and liver, where there is a fatty degeneration of the liver, nephritis, the peculiar lung lesion, the cerebral lesions and a peculiar hemorrhagic lesion in the voluntary and cardiac muscles. The lung lesions are similar to those described in man. In man, while there is evidence of disease of the lung, the coarser signs, such as marked dulness on percussion, tubular breathing, adventitious sounds, may all be absent in the early stages. On careful examination, however, even within twenty-four hours of the onset, an area, even involving an entire lobe may be found where the breath sounds are weak. Later, the percussion note becomes impaired, although not dull, and a few fine rales may be heard on auscultation. The important physical sign is that there is a definite area large or small, as the case may be, in which there is weakness of the breath sounds. In the experimental animals it was found that the virus produced marked vascular lesions in the small arteries.

The disease is not to be regarded as a localized process of the respiratory tract, but as a general infection of the blood stream. The experimental reproduction of the disease was done by Bashford. Using the sputum filtrate of the isolated virus, 41 primary inoculations were made. These were done on monkeys (Rhesus) when available, and laboratory bred rabbits and guinea-pigs. Positive results were obtained in 19 out of 20, there being one doubtful exception of a rabbit. This conclusion is based on the evidence during life or after death respectively, or on the combined evidence of both. The symptoms produced were similar, irrespective of the method of inoculation and material used. Of the monkeys only one exhibited marked muscular contractions which may have been meningeal in character. The others showed injection of the conjunctivæ on the second, third and fourth day, with running of the eyes and nose. On about the fourth day there was shivering and the hair stood up. There was also sneezing, audible breathing, rales and cough. None of the monkeys appeared seriously ill and none died. One was killed after a primary inoculation, being seriously ill with pulmonary symptoms from twenty-four hours onward, and showed no particular postmortem lesions. In guinea-pigs these symptoms were all more marked. All of the animals that died or were killed showed obvious lesions of the lung, liver, kidneys and heart. In one case there was macroscopic hemorrhage into the anterior abdominal wall.

The age of the cultures used varied from four to ten days' growth. It seemed that, irrespective of the method of inoculation, the younger cultures produced a more marked effect, the incubation period being shortened to twenty-four hours when the four days' growth was used, as contrasted with three days for a nine days' growth. The size of the dose inoculated influenced the severity of the effect rather than the rapidity of onset when given intravenously, although there was no noticeable difference following the different size dose when injected subcutaneously. The most constant and rapid effect was obtained by subdural inoculation, intravenous injections next, and little or no effect evident followed the subcutaneous injection of as much as 1.5 c.c.

The organism has been recovered from the blood, liver, lung, kidney,

urine, glands, and from the bile of animals having the disease as the result of inoculation. The disease was passed from animal to animal in guinea-pigs by the transference of full blood, citrated blood, bile, urine, and emulsion of the lung two to ten days after the primary inoculation. The virulence of the organism was found to be enhanced in the case of the blood, bile and the emulsion of the lung. When the blood was used, a very severe, practically fatal, disease resulted, and this also followed the use of the emulsion of the lung. The bile, injected subdurally, produced a very severe type of the disease, and intraperitoneal injections produced a very typical illness, but did not cause death.

The *histological changes* were desquamation of the endothelium of the vessels, the fluid from the clotted blood transudes into the inner layers of the vessel walls. The microscopical lesions of the lung were all referable apparently to an injury to the vessels, especially to the lining endothelium. The fluid pervading the lungs may be partly a pressure edema due to arteries remaining patent where veins are closed, and partly due to the squeezing of fluid from the fibrinous clots. The vascular lesions were also noted in the other organs.

The bacteriology was studied by Wilson. Studies were made of the blood, the sputum, pleural fluid, the urine, and postmortem tissues. The results of his observations as originally stated may be summarized briefly as follows: An organism, of definite morphological and cultural characters, has been isolated from cases of influenza. It can be demonstrated in the blood, sputum, and other exudates, and in the tissues, postmortem, by appropriate methods of staining. It belongs to the group of "filter-passers," a group of organisms which pass through bacteriological filters. It has been seen microscopically in the filtrate and has been cultivated therefrom. It has not been found in large series of controls.

Using the Noguchi method, there were certain differences depending upon the material used for the growth. When whole blood or washed red corpuscles were used, minute yellowish colonies made their appearance on the fourth or fifth day. These rapidly increased in size and became confluent on the seventh day, and formed a faint yellow, continuous, and moderately adherent layer, showing slight ridging of its surface. Owing to the transparency of the medium, plasma cultures, or cultures of pleural fluid, showed evidence of growth as early as the third day, and it took the form of a fine granular haze seen in the vicinity of the rabbit tissue. Sputum, sediments, and filtrates usually show a certain growth by the end of the second day, by reason of the larger number of organisms present. The subcultures show growths of minute grayish-white colonies after forty-eight hours' incubation, but in the fourth generation the organism usually dies out. The organism is anaërobic and remains so in subculture, and growth only takes place at the temperature of the body. From cultures the organism has the appearance of a minute, rounded, or slightly oval, undifferentiated coccus-like body, arranged in colonies of twenty to sixty elements, the individual elements showing sometimes a tendency to occur in pairs. It shows a considerable variation in size, the smallest forms being 0.15

of a mikron, the largest 0.5. The small forms predominate in the young cultures, while the large ones are most numerous in the older cultures. The organism presents certain difficulties in staining and little effect is produced by the ordinary dilute solutions of aniline dyes. With Giemsa's stain applied for twenty-four hours, the organisms stain a dark purplish-blue, but the preparations are not satisfactory owing to the staining of the background. Good results have been obtained by fixing in methyl alcohol and first washing the films in ether for two minutes, thereafter staining in 1 per cent. methylene blue, or in Kuhne's blue, for one hour. The organism is not acid-fast, the young cultures stained by Gram's method retain the stain, while the old ones show a predominance of Gram-negative elements. In exudates, satisfactory results are obtained by Gram's method.

The organism passes through Berkefeld filters N and V, and the Massen porcelain filter. The Berkefeld filters permit organisms up to 0.5 of a mikron to pass through them. The Massen filters are of a higher standard and some allow organisms no larger than 0.1 of a mikron to pass through. The organism is somewhat resistant to heat, the thermal death point was found to be 68° C., and it also resists the action of glycerin, but not as markedly as the virus of rabies or poliomyelitis.

The organism has been found in cases of influenza, but was not noted in over 60 controls drawn from cases of trench fever, encephalitis and certain of the exanthemata. During the early stage of the disease the organism is present in the blood and can be recovered as early as twenty-four hours after the onset. It persists in the blood for about two days before the decline of the fever. The blood was studied in 25 cases, and the organism isolated in 22. In the sputum, the organism was found almost from the onset, but with the development of bronchopneumonia it is to a great extent masked by the secondary infecting agents, the pneumococci, streptococci, etc. The length of time it persists in the sputum after the patient's recovery has not been determined. In 40 cases in which the sputum was examined, the organism was recovered in every instance. It was also found in 14 out of 16 chest fluids examined.

Arkwright⁶² has tried to culture the virus of trench fever and of influenza, but without success and has criticised sharply the findings of Bradford and his associates. He believes that he was unable to distinguish macroscopically or microscopically between the tubes inoculated with influenza virus and the control tubes at any period between their first inoculation and three weeks later or over a longer period. He believes that some of the tubes were contaminated with other organisms and that some of the appearance about the kidney tissue may have been due to autolysis.

In reply to this, Bradford and Wilson come out in the same journal with short statements, Bradford saying in addition to other things: "As regards the interpretation to be attached to the minute Gram-positive bodies that were described as organisms, and are so regarded by Captain Wilson, and which Dr. Arkwright looks upon as mere

⁶² British Medical Journal, August 23, 1919, p. 233.

deposits of protein, it is clear that no final conclusion can be reached as to their being organisms until they have been obtained abundantly in unquestionably pure cultures. Hence, at the present moment it cannot be claimed that this work has proved that filter-passing organisms in the diseases in question have been grown in pure culture."

Wilson's statement in part is as follows:

"1. These films and cultures, when stained by Gram's method, showed cocci and diphtheroid bacilli.

"2. It is also correct that microscopically the degenerated forms in these films were mistaken by me for filter-passing organisms.

"3. The minute bodies which Dr. Arkwright suggests are but deposits of protein, and were the bodies originally described by me as filter-passing organisms. They are Gram-positive, they have not been found by me in controls, while they have been present in the Noguchi cultures and also in those in which the serum constituent was replaced by glycerin. During the past two months attempts have been made to obtain clean cultures of these bodies, but have been unsuccessful.

"There is another point to which reference may be made, as it may be of use to others: Dr. Arkwright suggested that insufficient use had been made of the ordinary methods of cultivation; this is not correct. Adequate controls of the rabbit kidney and the inoculum were always made, and it was apparently only when the kidney and inoculum were associated anaerobically that growth took place.

"In conclusion, it has to be stated that it has not been proved that a filter-passing organism has been grown in pure culture in any of the diseases for which the claim was made."

This leaves the observations of Bradford and his associates somewhat in doubt, but apparently only as regards the culture part of their work. As no statements were made regarding the inoculations, it may be assumed that they believe that part of their work to be correct. The fact that other observers of unquestionable ability have demonstrated a filtrable virus is a very important point, and among the various publications the following may be noted:

Gibson, Bowman and Connor⁴³ have also found a filtrable virus and published their preliminary experiments in December, 1918 (*British Medical Journal*, December 14, 1918). They were influenced in their investigations by the work of Foster⁴⁴ on the Etiology of Common Colds. They did not make a very large number of observations, but from the evidence which they have they believe they are able to make the following deductions: The inoculation of filtered and unfiltered sputum in cases of influenza, especially in the early stage, is found to produce lesions in the lungs in a high proportion of inoculated animals. The inoculation of the blood may not always produce such striking results. The pathological lesions in animals, of course, resemble those seen in man. There is some evidence in favor of the view that passage of the virus from one animal to another may raise its virulence. Using the Noguchi methods, they were able to grow a minute organism of a coccoid

⁴³ *British Medical Journal*, March 22, 1919, p. 331.

⁴⁴ *Journal of Infectious Diseases*, November, 1917, No. 5, ii, 451.

shape from the kidneys of infected animals, from the filtrates of lung tissue and from the filtered sputum. The cultures have been carried to the third generation by direct culture, and, when inoculated into animals, produced typical lesions. The organism can be recovered from these experimental animals. It will not be necessary to go into detail further on their observations, inasmuch as the organism seems to correspond to that described by Bradford, Bashford and Wilson.

One of the first to announce the discovery of a filtrable virus was Nicolle, whose researches were assisted by Lebailly. His observation was reported to the Academy of Sciences on the twenty-first of October, 1918, and a more extended account given in the *Annales de l'Institut Pasteur*, vol. 33, June, 1919, p. 396. It will not be necessary to give in detail the experiments, but to give their summary and their results will suffice. Taking first their observations on the role of bacteria associated with the disease, they found, as have other observers, a variable bacterial flora in the nasal and buccal secretions. These were composed of pneumococci, streptococci, various other cocci and Pfeiffer's bacillus and spirochete. They found the spirochete very abundant in the sputum from foci of the epidemics and also where pulmonary complications were present. The influenza bacillus of Pfeiffer was met with only rarely. They succeeded, however, in growing it upon agar mixed with pigeon blood. This organism is very small and it has been urged that it is possible it might pass through the Chamberlain filters and thus be an invisible agent which causes the disease. In all their experiences they found it impossible for the Pfeiffer bacillus to pass through the filters which they used and through which the virus which they believe to be the cause of the disease did pass. They believe that the virus is found in the bronchial expectoration of the patients and that using this by the nasal or subconjunctival route it is possible to infect monkeys such as the *Macacus sinicus*, *M. cynomolgus*. Cats and guinea-pigs, however, are refractory. The virus will pass through the filters and by using the filtered sputum they have reproduced the disease in two individuals who were inoculated subcutaneously. Injected intravenously, the disease did not develop. They believe it is possible that the virus is not present in the blood. They also determined the fact that the influenza virus does not retain its virulence over a long period outside of the animal affected by it. In their observations, drying for forty-eight hours is sufficient to kill it.

They believe that influenza is a disease caused by this invisible microbe which is exceedingly active and very contagious and that it acts through its poisons by disorganizing very rapidly the natural defence of the body. It disappears quickly; perhaps does not invade the blood, but leaves the patient in a state of very feeble resistance to the usual germs of secondary infections. These rapidly make an invasion and through changes brought about by them the clinical picture may be dominated and altered, usually causing an extremely grave condition in the patient.

In a like manner da Cunha, Magalhaes and Fonseca,⁶⁶ working in the

⁶⁶ *Memorias do Instituto Oswaldo Cruz*, 1918, fac. II, x, 174.

Instuto Oswaldo Cruz, either in Rio de Janeiro or in the branch at Bello Horizonte, were able to isolate a filtrable virus from cases of the disease. They found this in the blood in certain stages of the malady and also in the sputum. Both the blood and the sputum generally retain their virulence after filtration, but, when there is a loss of virulence, it is usually due to retention in the filter, a point which has been brought out in working with other diseases. The virus as it exists in the blood, as well as in the sputum, may produce the disease in different animals when it is given either before or after filtration, the reaction taking the form of an intense or prolonged pyrexia following after a period of incubation. An interesting point that they bring out is that they believe that the virulent filtrate heated and treated with phenol seemed to have curative properties. They also used autohemotherapy and made observations in 49 cases. At the beginning, doses between 5 and 10 c.c. were injected under the skin of the same patient immediately after drawing off the blood. Later the doses were increased to a maximum of 30 c.c. They believe that this method of treatment will be found to be efficacious during a certain stage of the disease, but is as yet rather poorly defined. They were able to produce an immunity in a monkey by one inoculation of filtered sputum. Up to a certain period, a skin inoculation was without effect. The reaction of fixation between the human serum and the filtrate is negative.

Yamanouchi, Sakakami and Iwashima^{**} have made similar studies on cases of influenza that occurred in Japan. Up to the end of January, 1919, it was estimated that there were nearly 30,000,000 cases in Japan, of which 170,000 proved fatal. They made an emulsion of the sputa of 43 influenza patients and injected it into the nose and throat of 12 healthy persons. A filtrate by a Berkefeld filter of the same emulsion was injected into the nose and throat of 12 other healthy persons. Six of the individuals had previously had influenza and all of these six remained perfectly well, whereas all the other 18 subjects were attacked by the disease after an incubation of two or three days. A filtrate of the blood injected into the nose and throat of 6 other healthy persons also produced the disease. The subcutaneous inoculation of 4 healthy persons with the filtrate of the sputa emulsion, and of 4 others with the filtrate of the blood caused the disease in all with the exception of one who had previously had influenza. These observers were unable to produce any disease by injecting pure cultures of either Pfeiffer's bacillus alone or mixed with streptococci, pneumococci, staphylococci, diplococci and other organisms commonly isolated from the sputum of influenza patients. They conclude that these organisms are not the cause of influenza, but that it is due to a filtrable virus which is present both in the blood and in the sputum.

Next in point of interest is the presence or absence of the influenza bacillus of Pfeiffer. The epidemic of 1889 and 1890 brought forth a number of observations made by more or less competent bacteriologists who found various organisms. Capsulated diplococci, streptobacilli

^{**} *Lancet*, June 7, 1919, p. 971.

and protozoa were all noted. In 1892, Pfeiffer announced his discovery of the influenza bacillus and since that time to the present this has generally been credited with being the cause of the disease. These statements have not, however, passed entirely unchallenged and Rosenthal, in 1900, and others, have questioned the role of the Pfeiffer bacillus in influenza. In 1910, Vincent suggested that epidemics of grippe might be due to a filtrable virus. In the epidemic of last year the bacillus of influenza was reported in large numbers by certain observers and in smaller numbers by others, and sometimes it was not found at all. Keegan, in a series of 23 autopsies, found the influenza bacillus in the lungs in 82 per cent. of the cases and in 32.6 per cent. it was in pure culture. The Conference of Bacteriologists at the British War Office under Leishman, believed that the influenza bacillus played a part of great importance in the epidemic, although they were not sure of its being the primal cause.

Among other investigators may be mentioned Crofton.⁶⁷ He isolated the organism from the first cases without difficulty, using agar according to Eyre's directions containing 1 c.c. of fresh defibrinated unheated blood to each 10 c.c. He did not find an organism similar to this previous to the present epidemic. He believes it to be the cause of the disease because he isolated it from a large number of cases and because he produced a purulent influenza bacillus antigen which caused a marked degree of prophylaxis even in small doses, and he states that it rapidly cuts short the disease when it is uncomplicated and cures all the after-effects. A pure influenza antigen can produce all the symptoms and the serum of influenza patients agglutinates the influenza bacillus, in his belief.

Let us glance hastily at the results obtained by some other observers; this could be extended tenfold, nay a hundredfold, but to no good purpose. Synnot and Clark⁶⁸ reported that they had found it in the majority of cases when looked for. They found it in the lungs, bronchi, and trachea, but in over 300 blood cultures it was not present. Hall, Stone,⁶⁹ and others in 78 uncomplicated cases found various organisms in the sputum; the bacillus of influenza 58 times, *Micrococcus catarrhalis*, 39 times, and hemolytic streptococci, 4 times. Averill, Young and Griffiths⁷⁰ found the influenza bacillus in 75 per cent. of cases, but also found the pneumococcus in the same percentage. Dietrich and Neisser⁷¹ found the influenza bacillus in 100 per cent. of cases. Similar results were noted in Budapest. Rapport⁷² found it in over 80 per cent. from autopsy material. Stillman and Pritchett,⁷³ using Avery's oleate medium, found the influenza bacillus in 93 per cent. Japanese observers, Okawara, Tanaka,⁷⁴ and others, working in the Kitatsato Institute believed

⁶⁷ British Medical Journal, March 1, 1919, p. 240.

⁶⁸ Journal of the American Medical Association, November 30, 1918, p. 1816.

⁶⁹ Ibid., December 13, 1918, p. 1987.

⁷⁰ British Medical Journal, August 3, 1918, p. cxi.

⁷¹ München. med. Wchnschr., 1918, lxx, 928.

⁷² Journal of the American Medical Association, March 6, 1919, p. 633.

⁷³ Journal of Experimental Medicine, March, 1919, p. 259.

⁷⁴ Kitatsato Archives of Experimental Medicine, 1918, p. 235.

the influenza bacillus to be the cause of the disease. Hicks and Gray⁷⁵ found the influenza bacillus in 80 per cent. in the nasopharynx and in 75 per cent. in the sputum. In the Argentine, Ruiz⁷⁶ found the influenza bacillus either alone or with other organisms in 126 cases, or 35.79 per cent., and in 57 it was found alone. The same observer found the pneumococcus either alone or associated in 68.4 per cent. of his cases. Kraus and Kantor⁷⁷ found the influenza bacillus in 60 per cent. associated with pneumococci, streptococci and parameningococci. Netter believed the influenza bacillus was the cause of the epidemic. Richet and Barbier⁷⁸ found the influenza bacillus in 55 per cent. of the cases examined and the *Micrococcus catarrhalis* either alone or with other organisms in 39 per cent., streptococci, either alone or with other organisms in 18 per cent. and other organisms in 5 per cent.

Stachelin⁷⁹ found the influenza bacillus in the sputum and in the blood, especially in the cases that develop bronchopneumonia. In Spain, among others, Ruiz, Falco and Tapia found the influenza bacillus in the sputum during the epidemic. Similar observations were made by Garagia⁸⁰ in Valladolid. In Italy, Marantiono and Blassi and Micheli give the influenza bacillus as the chief offender.

All the above observations lay great stress on the presence of the influenza bacillus, either as a primary cause or as a secondary invader, but there are numerous other observers whose findings are almost directly the opposite. For example, Bircher⁸¹ found streptococci. Uhlenhuth⁸² found the influenza bacillus in only 13 per cent.

Howell and Anderson⁸³ made a study of the complement fixation of influenza serum and obtained a large number of positive results with certain strains of viridans group of streptococci isolated from cases at Camp Meade and in Chicago. The evidence indicates that the organism plays an important part in the morbid process in several other places, and the serum from influenza patients in several different places appears to have acquired similar new properties.

Pritchett and Stillman,⁸⁴ using oleate hemoglobin agar, have been able to cultivate the influenza bacillus from the mouth of 93 per cent. of cases of influenza and bronchopneumonia. At the time the study was made the organism was demonstrated in 43 per cent. of normal individuals. They also demonstrated that the types of pneumococci found associated with complicating bronchopneumonias of influenza are of the types that are ordinarily found in normal mouths.

Of unusual interest in this question of etiology are some observations of Parker.⁸⁵ Her work was undertaken bearing in mind two suggestive

⁷⁵ Lancet, 1919, p. 419.

⁷⁶ La Semana Medica, September 4, 1919, p. 252.

⁷⁷ Revista del Instituto Bacteriologico, Buenos Ayres, March, 1919.

⁷⁸ Paris médicale, November 16, 1918.

⁷⁹ Cor.-Bl. f. schweiz. Aerzte, August 10, 1918.

⁸⁰ Medicina Ibera, June 22, 1918.

⁸¹ Cor.-Bl. f. schweiz. Aerzte, 1918, p. 1338.

⁸² Medizinische Klinik, 1918, p. 777.

⁸³ Journal of Infectious Diseases, July, 1919, p. 17.

⁸⁴ Journal of Experimental Medicine, 1919, xxix, 259.

⁸⁵ Journal of the American Medical Association, February 15, 1919, p. 476.

points, first the rapidity of onset, suggestive of an overwhelming intoxication, which may be due to a soluble toxin; and secondly, a marked leukopenia present in most cases. Five different strains of Pfeiffer's bacillus were grown on various media. The poison was produced with remarkable speed, toxic filtrates having been obtained from six to eight hours after incubation. At this time the organisms were growing very rapidly. The rate of growth, however, bore no relation to poison formation. Most of the material used were growths from eighteen to twenty-four hours. These cultures were centrifugalized and the supernatant fluid filtered through a Berkefeld filter. This filtrate was sterile and deteriorated very quickly, even when kept in the ice-box. By injecting this sterile filtrate intravenously in the rabbits it was found that 1 c.c. would produce death, but more often 2 c.c., or over, were required. After a period of about thirty minutes there was an increase in weakness often accompanied with diarrhea, and death usually occurred within three hours, with or without convulsions. It was found that the serum of rabbits that were immunized to multiple lethal doses of the poison will protect normal animals against lethal inoculation of the poison, and the immunity produced against a poison from any one strain will protect against a poison of any other strain. This protection is shown in two different ways: first, by mixing the lethal dose of the poison *in vitro* with the serum before inoculation; and secondly, by giving the serum fifteen minutes before or fifteen minutes after the injection of the poison.

Along the same line is the study by Huntoon and Hannum.⁸⁶ They present a very considerable amount of experimental evidence and show that the influenza bacillus is capable of producing a toxic substance and that when this is introduced into the respiratory tract it causes hemorrhages into the alveoli. When organisms invade the tissues, that is, when there is symbiotic growth, there is a tendency to cause a greater liberation of the toxin, and that as an effect of the action of the poison the way is made for the invasion of various organisms with the production of secondary lesions. They believe that live bacilli introduced at a remote point probably affect the lungs through the action of a liberated toxin. They also believe that there is nothing to preclude the consideration of this organism from being an important factor as the cause of clinical influenza.

Jordan,⁸⁷ in studies made in the Student Army Training Corps of the University of Chicago, found the influenza bacillus in 64 per cent. of the epidemic influenza cases, and it appeared that there were much larger numbers in the throat toward the end of the outbreak. The Mathers coccus, which was isolated at Camp Meade in September, 1918, was found with about the same frequency. This organism, which is probably about the same as that described by Zingher⁸⁸ resembles an ordinary mouth streptococcus in some of its characteristics, but its colonies on blood agar are much like pneumococcus, although, as a rule,

⁸⁶ Journal of Immunology, July, 1919, p. 167.

⁸⁷ Journal of Infectious Diseases, July, 1919, p. 28.

⁸⁸ Journal of the American Medical Association, 1919, lxxii, 1020.

larger, moister, and more confluent. Morphologically, and in colony growth, it is closer to the pneumococcus than to the streptococcus, but the fermentation characters are those of the ordinary mouth streptococci. It seemed to be more closely associated with the pneumonia cases than with the influenza bacillus of Pfeiffer, but it was later found in all cases of simple influenza. The pneumococcus is found in about 20 per cent. of cases and certain other organisms are found at times, such as the *Micrococcus catarrhalis*, the bacillus of Friedländer and staphylococci.

Dick and Murray,⁸⁹ in a study of a group chiefly drawn from the civilian population, found the *Micrococcus catarrhalis*, staphylococci, hemolytic streptococci, various types of pneumococci, including Type III, and the influenza bacillus. Usually these organisms were mixed cultures, but sometimes single. The influenza bacillus was the one most constantly present in October when the influenza epidemic was at its height, and the only one found in the blood cultures of patients who recovered. The influenza bacillus may be present in pure culture early in the disease and may be supplanted by the pneumococcus later and in this series none of the patients died. The leukocyte count in cases of pure influenza bacillus infection was low, corresponding to the leukopenia regarded as characteristic of epidemic influenza.

Another article along the same lines is by Wilson and Steer⁹⁰ who firmly believe that from their observations Pfeiffer's bacillus acts as a pioneer and prepares the way for the pneumococci, staphylococci and streptococci which produce lesions in the lungs and other tissues.

Others who had negative findings in this line were Pfeiffer, who found the organism but rarely, and Grüber of Munich, Friedman of Berlin, Kolle, of Frankfort, and Mandlebaum and Kroner. A number of the English observers, as Burnford, Williams, Griffiths and Low did not find the influenza bacillus. Some observers found the diplococcus, as Peset, Rincon, Colvée in Spain; Renault in Switzerland, de Fressine and Lovelle in France, and Jongh and Griffiths in London. Friedman, in Berlin, isolated the pneumococcus and sometimes with it, streptococci.

OTHER ORGANISMS. Then opposing these observations are those of Courmont, Durant and Dufaurt,⁹¹ in the Bacteriologic Institute at Lyons who, in 158 observations came to the conclusion that the pneumococcus was met with in but a very small number of cases, and they believed that the streptococcus plays a large part in the disease. They found both the hemolytic type and the viridans. There are numerous authors who found the streptococci. Hadour and Denier⁹² found streptococci in the blood in severe cases and in the fluid from the pleural cavity and in the lungs in all cases. Lacassagne,⁹³ while finding a large number of organisms in different associations, was not able to consider any particular one as specific, but he met with the streptococcus in a large per-

⁸⁹ *Journal of Infectious Diseases*, July, 1919, p. 6.

⁹⁰ *British Medical Journal*, May 24, 1919, p. 634.

⁹¹ *Compt. rend. des seances Soc. de biol.*, 1918, No. 19.

⁹² *Bull. de l'Acad. de méd.*, 1918, No. 36.

⁹³ *Jour. de méd. Français*, January, 1919.

centage of cases. MacCallum⁹⁴ found in some regions that the influenza bacillus was common and in others not, but he apparently failed to take into account the period at which the cultures were taken. Rosenau found a diplostreptococcus of the green-producing variety, and other observers, too numerous to mention, have had a somewhat similar experience. Coca, in Spain, believed the disease to be due to the *Micrococcus catarrhalis*, and Salvat, working in the same country, described certain parameningococci. Lucke, Wight and Kime, who studied the bacteriologic findings with relation to the time of the epidemic, found in the early days a predominance of the influenza bacillus and a non-hemolytic streptococcus. As the former subsided the latter increased. As these in turn diminished, the *Micrococcus catarrhalis* began to attain some prominence, and this was followed by another period in which there were the hemolytic streptococcus and the staphylococcus with a curious recurrence in a certain number of cases of the influenza bacillus.

In this connection it is not out of place to call attention to the observations of Segale.⁹⁵ He has described an organism which he calls streptococcus pandemicus, which he believes to be the cause of the disease because, when it was inoculated into the mucous membrane of healthy animals, it was possible to reproduce the syndrome seen in epidemic influenza. The bouillon cultures of this organism three days old, contained germs which will pass the Chamberland filter with the results that it is apparently perfectly sterile, but 0.25 c.c. of this inoculated into a guinea-pig is sufficient to produce death in six days after showing pyrexia and disturbance of the respiratory apparatus. Autopsies show congestion of the trachea, hyperemia of the lungs with infarcts, ecchymoses in the pleura, and so on.

PATHOLOGY. A very good study dealing particularly with the histopathology of the disease is by Lucke, Wight and Kime.⁹⁶ They refer in their work to two studies made during the pandemic of 1889 which may be consulted with great benefit. One is a monograph by Leichtenstern and Sticker,⁹⁷ and the work of Kuskow,⁹⁸ who studied 40 undoubted cases in 1892 at Petrograd. Space will not permit a careful review of their work, but a brief summary will be found to contain a number of points of importance.

In their experience they found that the negro soldiers were not as prone to have influenza as the white ones, but, when they did contract it, their chances of dying were considerably greater. The cases of the disease which came to autopsy usually presented an extreme lividity and the chest was usually found in a state of expansion. About 10 per cent. showed jaundice in addition, 20 per cent. showed purpura hemorrhagica, and 60 per cent. toxic necrosis of the sebaceous follicles. In 3 instances they found generalized emphysema which they thought

⁹⁴ Journal of the American Medical Association, March 8, 1919, p. 720.

⁹⁵ Il Policlinico Sezione Pratica, March 9, 1919, p. 289, and Pathologica, 1919, p. 243.

⁹⁶ Archives of Internal Medicine, August, 1919, p. 154.

⁹⁷ Influenza, 2d edition, Vienna and Leipzig, Alfred Hoelder, 1912.

⁹⁸ Zur pathologischen Anatomie der Grippe, Virchows Archives, 1895, cxxxix, 406.

was due to an ulcerative bronchiectasis, with an escape of air into the peribronchial tissue and thence to the mediastinum and subcutaneous tissue. In about 10 per cent. of the cases they noted Zenker's hyaline degeneration of the rectus muscle. The heart muscle was practically always affected, and in 90 per cent. of cases there was more or less relaxation of the right heart, and in over 80 per cent. an associated cloudy swelling. Curiously enough, endocarditis was seen in only one instance. The respiratory mucosa were generally somewhat swollen and very often hemorrhagic. The peribronchial lymph nodes were congested and enlarged, and the trachea and bronchi showed a hemorrhagic or a catarrhal condition. The accessory nasal sinuses showed purulent or sanguinopurulent involvement in 85 per cent. of the cases. In over 80 per cent. there was involvement of one or both pleura, and petechial subpleural hemorrhages were very frequent. The lung conditions have been noted elsewhere.

They found microscopically three types of exudate, catarrhal, fibrino-catarrhal, and fibrinopurulent. All of these occurred in the same lung or even in the same microscopic section. In over 80 per cent. of the cases the spleen was definitely enlarged, and very considerably so in 30 per cent. The adrenals were usually congested and somewhat edematous, and in 3 instances a frank hemorrhage was noted. Likewise, exhaustion was a most notable change. The liver was distinctly increased in size and weight in over 90 per cent., and focal necrosis was present in about one-half of the cases. In the pancreas there was toxic degeneration of the islands of Langerhans, which occurred with great frequency.

They believe that the anatomic and bacteriologic findings vary with the epidemic and stage of the disease and depend to a certain extent on the bacterial flora. Early in the epidemic the disease was more fulminating, and during this time the bacillus of influenza was most often found.

As the epidemic progressed and the attacks lengthened, secondary invaders appeared more and more frequently and corresponding anatomic changes were found. While the most notable changes were seen in the lungs, the alterations of the nervous, cardiovascular, and other systems must not be forgotten. The general changes produced by influenza are pronounced congestions, hemorrhages, toxic degenerative lesions and hemorrhagic inflammations. Hyperemia and hemorrhages are especially striking in the meninges, brain, serous membranes (petechial hemorrhages), skin (intense cyanosis, purpura hemorrhagica), lungs spleen, liver and kidneys. As examples of toxic degenerations are Zenker's hyaline degeneration of the rectus muscles, conglutination and hyaline thrombosis, hyaline degeneration of the vascular walls, hyaline degeneration of germinal centers of splenic follicles, the focal necrosis of the liver and so on. Hemorrhagic inflammations are shown in early involvement of the lung and in pachymeningitis. The pneumonia of influenza is characterized by extreme proliferation of the pulmonary epithelium, pronounced hyperemia and hemorrhage. The secondary invaders usually present cause an inflammation which grossly and

microscopically consists of a number of separate, dissimilar pathologic processes. To the naked eye there is a lobular pneumonia with a tendency to become pseudolobar, with a mixed, smooth and granular surface. Microscopically, there are four distinct types of exudates evident within the same microscopic section, but distinctly independent. These are catarrhal, fibrinocatarrhal, fibrinopurulent and purulent in type.

Throughout the disease there is a relative paucity of the polymorphonuclears and a proliferation of the lymphoid tissue, which would seem to point to myeloid intoxication and to lymphoid stimulation. In the chronic cases there is a negative tissue proliferation and a diffuse suppuration.

THE SYMPTOMATOLOGY. An extraordinarily good summary of the symptomatology of the disease has been made in a report by Abrahams, Hallows and French.⁹⁹ This report is made in connection with certain bacteriologic studies in which they tried to show that the disease is an infection by the influenza bacillus with a secondary infection by some other organism. It will not be necessary to go into this part of their paper, but a brief outline of their description of cases may prove instructive. They believe that what they call the straightforward influenza cases are similar to those of ordinary influenza as it occurs at other places and at other times. They noted a great frequency of epistaxis, that vomiting occurred in some and diarrhea to a less extent, and that abdominal pain was not a very marked feature. The temperature remained raised a variable length of days. The pneumonic cases may start off as such, or there may be symptoms of a milder type for several days before the onset of the pulmonary symptoms. The patient complains in some way of his chest, coughs with a dry hacking, often complains of pain on one or other side and occasionally has a scarlatiniform rash of transient duration, and in some there is a profuse clammy sweat, often leading to widespread sudamina. The breathing becomes rapid and varied from thirty to sixty times per minute, but there is no dyspnea in the sense of distress. The face is first flushed and red, but it speedily becomes less red and more of a lavender or violet hue, or, as the authors suggest, of a heliotrope color, suggestive of the color of soldiers who have been acutely gassed. The physical signs of the illness are extremely variable and neither diagnosis nor prognosis can be based on them. This is exceedingly important to bear in mind, as fatal cases may be noted in which the physical signs are limited to only a few rhonchi. In a general way, the patient looks like he had lobar pneumonia, but when the chest is examined there may or may not be signs of consolidation. In some, the entire course may be run, even to recovery, without any further signs than the rhonchi and a few rales posteriorly. Sometimes there is marked consolidation, at other times only a small amount. In another type of case there may be no bronchial breathing, but both lungs are full of crepitant or subcrepitant rales, and in still others one base becomes completely dull, with no breath or voice sounds. The use

⁹⁹ *Lancet*, January 4, 1919, p. 1.

of a needle shows the presence of a turbid fluid. Another feature serving to perplex the observer is the disappearance of bronchial breathing. It may be heard unmistakably and a few hours later nothing but the ordinary vesicular murmur is present. The bronchial breathing may recur and disappear again and again. The explanation of this is given that varying degrees of collapse may result from the accumulation of thick mucopus in the tubes and when a fair area of lung tissue has become temporarily airless from this cause, bronchial breathing may be heard over it, but when the mucopus is removed by coughing the lung may become reexpanded.

The sputum in these cases is usually very profuse, in some pure pus with a little froth, in some bright red blood, and in others rusty sputum. In others, there may be very little expectoration and in some none whatever. Quite apart from the more or less altered blood in the sputum itself, hemorrhage from the lung is a very common occurrence, but not as common as nosebleed, while hematemesis is rarely met with. The stools may be black, but whether this is due to swallowed blood or hemorrhage into the bowel is difficult to say.

Great stress is laid upon the color of the patient's face. As long as there is a distinct red in it, either of the whole face or in spots, there is always hope for recovery, no matter what the apparent condition of the lungs, temperature, pulse or respiration are. If this color changes to a heliotrope or lavender or a sort of violet color, the outlook is exceedingly grave, no matter how favorable the general condition of the patient otherwise may be as regards taking nourishment, absence from pulmonary distress and the rate of the pulse and respiration. The violet color may be confined to the lips and ears or it may affect the whole face, and while it is not impossible for these heliotrope cyanosis patients to recover this one feature alone is sufficient to permit one to pick out of a ward the patients who will probably die within twenty-four to forty-eight hours. The color did not seem to be due to the presence of methemoglobin, nor to any defect in the oxygen-carrying power of the blood, but is probably what Haldane has termed "anoxemia," similar to that seen in patients who have been gassed.

The absence of orthopnea was exceedingly noticeable. Few women and most men lie at ease at full length. This was probably due to the heart remaining pretty good until close to the end, failure of the right heart being the commonest cause of orthopnea, in other words, the cyanosis seen in these patients is not cardiac in its origin. The cough is variable, sometimes very troublesome, at other times almost absent. The heart, as a rule, as just remarked, generally continues in good order until shortly before death. There are, of course, numerous cases in which variations in the heart condition are noted, but the general rule is that the patients did not die of cardiac failure.

Herpes was noted about the lips in about 5 per cent. of the cases and sometimes was noted about the ears. Early in the disease there was a tendency of the upper eyelids to drop as if the patient were half asleep, and this occurs in individuals who are very toxic or who have taken narcotic drugs. There is a dulness of the conjunctivæ and the eyes are

more or less dazed. The mental condition is extremely variable. In patients without pneumonia some little delirium toward the morning hours was observed, but the pneumonia patients, as a rule, had a more or less severe delirium, although at times the mental condition seemed to be perfectly good. A high percentage of the more serious cases without reference to the outcome, showed subsultus tendinum. More or less deafness was noted in many cases in varying degrees. In a few cases there was swelling of the parotid glands. There is a peculiar definite smell about these patients, best noted when the bedclothes are first drawn back for examination of the chest.

The patients with pneumonia showed rather a high percentage with acute nephritis, as well, and it is very important to realize that many of these patients were without edema, although the condition could be ascertained by examining the urine. Curiously enough, the observers quoted did not encounter any case of meningitis in spite of the fact that they had a large experience with cases of the most extreme type. In over 20 they noted a rupture of one or both rectus abdominus muscles, usually in the part of the muscle which lies below the umbilicus. It is well known that changes are particularly liable to occur in these muscles and the rupture is doubtless brought about by the effort in coughing. They also noted the feature of widespread subcutaneous crackling of the deep tissues of the chest walls, the result of subcutaneous emphysema.

INFLUENZA PSYCHOSIS. At the Boston Psychopathic Hospital, 100 cases of mental disease associated with influenza have been studied by Menninger.¹⁰⁰ Eighty of these were analyzed intensively. The variety of mental disturbance manifested was found to be very great, and using Southard's classification it was found that 9 of the 11 groups of mental disease were represented. As a matter of convenience they may be put into four groups: Delirium, dementia præcox, other psychoses, and unclassified. Of these dementia præcox was the largest group numerically. The ages of the patients varied from sixteen to sixty-nine. The average age, according to the diagnosed groups, were as follows:

I. Delirium	32
II. Dementia præcox	23
III. Other psychoses	40
IV. Unclassified	34

Below eighteen years of age no serious mental complication was common. In the next decade the tendency is toward the development of dementia præcox, and in the succeeding decade toward some other psychotic entity. As a rule, there was an interval between the termination of the influenza and the development of the first symptoms of psychosis, the averages varying from two to eight days in all except the febrile deliria. The commonest symptoms were delusions and hallucinations, and depression is relatively infrequent, contrary to the case in mentally normal subjects. The following table shows the way influenza acted:

¹⁰⁰ Journal of the American Medical Association, January 25, 1919, p. 235.

LATENT PROCESSES ACTIVATED.

Dementia præcox	8
Manic-depressive psychoses	6
Neurosyphilis	5
Alcoholic psychoses	4
Other psychoses	5
Unclassified	4
Total	32

PROCESSES INSTIGATED.

Delirium	16
Dementia præcox	17
Manic-depressive psychoses	3
Other psychoses	0
Unclassified	12
Total	48

POSTINFLUENZAL ALOPECIA. One of the striking effects of the recent epidemic of influenza was the frequent occurrence of the loss of the hair. Hazen¹⁰¹ reports his experience with 50 cases. Three of these were in men and 47 in women. The reason for this difference in sex is that women are more apt to consult physicians in loss of hair than men, and it was noted by several of the more intelligent barbers that practically all of the customers who had had influenza lost much of their hair. Inasmuch as this was mostly in young people, it is only natural that the patients should fall in the same class. The loss of the hair bears a pretty direct relation to the severity of the infection, and while it has generally been assumed that a preëxisting seborrhea makes the loss of hair more certain, but Hazen's cases did not go to confirm this. Twenty of his 50 cases had had practically no dandruff, and the scalps of 22 of the 50 were absolutely free from any local trouble. The average time for the beginning of the alopecia after the disease was nine weeks, while the shortest was two weeks and the longest three months. The variation as to the amount of hair lost was extreme. In one patient there remained only a tuft of hair on the back of the scalp, while in another not more than one-tenth of the hair was lost. Ordinarily, the average loss was from one-third to one-half. Usually the long hairs fell out and were replaced by short hairs, so that it is possible that new hairs simply pushed out the old ones that had been damaged. In almost every instance the alopecia was diffuse, although in two instances there was a tendency toward patchiness. The greatest loss was usually over the anterior and parietal portions of the scalp. In 41 cases both the scalp and the hair were abnormally dry and in 12 there was sensitiveness, either local or general, of the scalp. In every instance the new hair grew in in a remarkably short space of time.

The treatment was to put the patient in as good physical condition as possible and free the scalp from any seborrhea. This was usually done by means of a sulphur ointment and then sufficient vegetable oil was supplied to keep the hair glossy. Massage of the scalp was done

¹⁰¹ Journal of the American Medical Association, May 17, 1919, p. 1452.

twice a day, and, where there had been a seborrhea, a stimulating lotion of one dram of salicylic acid to six ounces of alcohol or bay rum was employed.

Hazen does not believe there is any need for treatment with ultra violet light or with any form of electrical stimulation, and that there is no excuse for cutting the hair unless it be to make the ends even, so that it can be more easily dressed. The alopecia of influenza apparently does not differ from the postfebrile variety.

INFLUENZAL CROUP. During the epidemic there were quite a large number of cases of croup observed and a report on this subject has been made by Joseph and Catherine Regan.¹⁰² The cases were distinct from diphtheria, inasmuch as they had a history of close exposure to influenza, absence of the membrane from the tonsils, failure to respond to antitoxin, as well as the clinical course of the disease and the uncertain effects of intubation. They resembled laryngeal diphtheria so closely that in some instances the children were admitted to diphtheria wards. The disease generally begins with symptoms of influenza, but in from two to ten days laryngeal symptoms become marked. The course of the disease after that is not unlike typical laryngitis and depends somewhat on the severity of the laryngeal involvement and the presence or absence of a complicating pneumonia. The disease, however, is not influenced by diphtheria antitoxin. The symptoms of obstruction generally increase until there is marked asphyxia, especially during periods of spasm, and during these there was marked cyanosis, profuse sweating and extreme restlessness, as well as marked retraction of the suprasternal fossæ and epigastrium. There was noisy breathing and the radial pulse disappeared during inspiration. If pneumonia was present, it usually was not the prominent feature of the disease.

The croup was most common in children between three and ten years of age and was more common in boys than in girls. Out of a series of 20 cases, 5 died. Considering the extreme laryngeal stenosis, and the fact that most of the patients had a complicating pneumonia, this mortality is not very high. The cultures did not show any diphtheria bacilli, but the organism is ordinarily isolated in influenza cases. The influenza bacillus, streptococci, staphylococci, etc., were found in cultures from the lungs.

In 4 cases that were autopsied, the larynx was found to be intensely congested, the mucous membrane of the epiglottis was swollen and congested as were the tissues around the true and false cords. The congestion and also the edema, to a lesser extent, extended downward into the trachea and bronchi.

Steam inhalation, carried out in a small room where the atmosphere could be saturated with vapor, gave the most satisfactory results. Flaxseed poultices applied to the neck, and atropin sulphate given in doses suited to the age to control the spasms and restlessness were used. In 6, intubation was done. The introduction of the tube made the patient worse at first, and in 3 cases the tube had to be taken out, the

¹⁰² American Journal of Diseases of Children, June, 1919, p. 377.

explanation being that the pressure of the tube increased the pressure on the mucous membrane below it and so added to the mechanical obstruction.

ACUTE PULMONARY EMPHYSEMA IN INFLUENZA. Torrey and Grosh¹⁰³ have made observations on over 1000 soldiers with epidemic influenzal pneumonia at Camp Hancock. Inasmuch as the pathology and course of the disease, as they observed it, differed so much from lobar or bronchopneumonia according to the usual conception of these diseases, they suggest the name of *acute bronchitic emphysema*. In their cases there was an intense bronchitis and peribronchitis which was similar to that observed in a previous epidemic of pure hemolytic streptococcus infection. There was also present at the first a destructive softening of the lung parenchyma. In addition to this, there was always an early and general pulmonary emphysema which was frequently the main factor, causing death by interference with the mass movement of the venous blood. These conditions were found in every case examined at autopsy, and, with the exception of acute otitis media, there were almost no complications outside of the chest.

ROENTGEN FINDINGS IN THE PNEUMONIAS FOLLOWING INFLUENZA. Friedman¹⁰⁴ reports the results of his observations on this subject. In the patients seen early there was a rather marked peribronchial infiltration of the larger trunks, with a local or general mediastinitis; the lung structure was apparently normal, and the movements of the diaphragm unimpaired. In some instances this remained stationary and there was a corresponding improvement in the patient's condition; if this did not happen, there was a rapid invasion of the lung structure, usually with production of bronchopneumonia. In some cases there was a lobar pneumonia, and in some the infection produced a general pulmonary edema with an almost complete obliteration of the chest shadows; with this there was diffusion into the pericardium. The bronchopneumonias usually involved both lungs, although sometimes only one was affected, and, when there was extensive involvement, the movements of the diaphragm were impaired. In some, the entire chest became involved with only small areas of apparently normal lung. In these, considering the amount of lung involvement, it was difficult to see how the patients could breathe. There was also multiple abscess formation and empyema.

The point of greatest interest and the one which must be emphasized is that in the bronchopneumonias the x-ray findings are very similar to those found in pulmonary tuberculosis. In individuals who have had influenza or influenzal pneumonia, even months after apparent recovery, the diagnosis of tuberculosis should be made with great hesitancy, and only with as positive evidence as can be obtained.

HEART BLOCK AND BRADYCARDIA FOLLOWING INFLUENZA. During the epidemic of influenza a large number of cases of bradycardia were observed, both in the simple cases and in those with pulmonary complications. When the temperature reached normal the pulse-rate dropped

¹⁰³ American Journal of the Medical Sciences, 1919, No. 2, clvii, 170.

¹⁰⁴ Journal of the American Medical Association, November 30, 1918, p. 1847.

to sixty or below, and remained this way for a variable number of days. Cockayne¹⁰⁶ has made a study of some 132 cases in which the pulse fell below fifty. Polygrams were taken in 55, and in 19 it was found that the bradycardia was due to a condition of partial heart block, but no complete heart block was met with. In one case a sinus block was encountered in a boy of sixteen with a pulse-rate of forty. At first the entire cardiac cycle was missed almost every other beat. Later, the missed cycles occurred less frequently and less regularly, and the rhythm always became more normal toward the end of the day. The condition gradually disappeared until the sinus block only occurred once every two or three minutes and finally ceased altogether. The duration of the abnormality was about twenty-eight days.

A prolonged auricular and ventricle interval was noted in two men, aged eighteen and forty-four, and lasted nine and twenty-two days respectively. In 9 cases, 2 : 1 heart block was found, and lasted from one day to thirty-three days, the average being twelve days. As the heart block became less complete, intervals of irregular pulse were noted. There were also 6 cases of 3 : 1 heart block, with an average duration of fourteen days. It was found impossible to differentiate these cases of heart block from simple bradycardia by clinical observation. It was found that on the average the simple bradycardia was of shorter duration, usually averaging four or five days. It seems probable that the heart block and simple bradycardia are both due to the same toxin, but the pulse-rate of less than fifty, or partial heart block was always associated with some involvement of the lung and it was also noted that severe infection of the lung with streptococcus apparently prevents the occurrence of marked bradycardia or heart block. Atropin in doses large enough to cause slight poisoning was used in 4 cases and produced a slight and only temporary increase in the pulse-rate, while inhalation of amyl nitrite in one case of simple bradycardia, given a day or two before the condition began to clear up, raised the pulse-rate from forty-eight to one hundred and twenty, but a minute later it was forty-eight again.

THE BLOOD PICTURE OF INFLUENZA AND OF THOSE INOCULATED WITH INFLUENZA VACCINE. There are any number of contributions to the subject of the blood condition in the recent epidemic of influenza. In a general way a more or less marked leukopenia has usually been noted. Little, Garofalo and Williams¹⁰⁶ reported that the change seen is a slight leukocytosis with a proportional increase of the small lymphocytes. When the examination is made early, the leukopenia has been reported sometimes as low as 1800 and averaging from 3000 to 4000. Such findings have been reported by Nuzum, Pilot, Stangel and Bonar.¹⁰⁷ They found that at the onset of a pneumonia there was a definite leukopenia. Keegan,¹⁰⁸ taking cases examined from the first to the fourth day, found an average leukocyte count of 6700, of which 63.7

¹⁰⁶ Quarterly Journal of Medicine, July, 1919, No. 48, xii, 409.

¹⁰⁶ Lancet, July 13, 1918, p. 34.

¹⁰⁷ Journal of the American Medical Association, November 9, 1918, p. 1562.

¹⁰⁸ Ibid., September 28, 1918, p. 1051.

per cent. were polymorphonuclears and 33.3 per cent. lymphocytes. Strouse and Bloch¹⁰⁹ found a leukopenia, as a rule, except in cases in which empyema developed. Keeton and Cushman¹¹⁰ found a large number of cases showing leukopenia in the early stages. Blanton and Irons,¹¹¹ in a study of 580 cases in which the counts were made before any pneumonia developed, found a low count in a very large number. In 70 per cent. there were less than 8000 white cells. They found a slight increase in polymorphonuclears over the normal and no conspicuous lymphocytosis. In 1000 counts in pneumonia patients, 67.5 per cent. showed 8000 or less cells. Ely, Lloyd, Hitchcock and Nickson,¹¹² in 75 counts, found 25 with 5000 or less, 34 between 5000 and 10,000 and 16 over 10,000. Brem, Bolling and Casper¹¹³ found a leukopenia practically always in the first stage of influenza and also early in pneumonia cases. The average in 86 influenza cases was 6000, and in 148 pneumonia cases, 6800. The absence of leukocytosis has been noted also by Sinnott and Clark,¹¹⁴ while Gotch and Whittingham¹¹⁵ reported a distinct leukopenia. Cole¹¹⁶ also reports a leukopenia in the toxic cases and some in bronchopneumonia.

Studies have also been made by McConnell,¹¹⁷ who averaged the results of the above observations and found that there were approximately 5700 cells per cubic millimeter. He got the idea that some information might be obtained by making white cell counts of those who had been given an influenza vaccine made up of various strains. In the individuals who received the vaccine, the averages were a total of 10,000 white cells for the officers and 7700 for the enlisted men, and he came to the conclusion that the subcutaneous injections of the influenza bacillus does not have any effect on the tissues concerned in the formation of the white cells. Since the general opinion of clinicians that a leukopenia is one of the characteristic findings in the recent epidemic, it would seem justifiable to consider the findings here reported as an additional argument against the bacillus of Pfeiffer being the causative agent.

INFLUENZA NEPHRITIS IN CHILDHOOD. Ordinarily it has not been believed that influenza was liable to produce nephritis in childhood, although colds, especially if accompanied with slight changes in the nose and throat, have been given as a cause. Giacobini¹¹⁸ has, however, made a report on a number of cases following an attack of influenza. There were both anatomical and functional changes, and he believes that these should be classed along with the cases of nephritis caused by other diseases of childhood, such as scarlet fever and diphtheria. The general conception of this form of disease is that there is profound alteration in the blood and changes which permit the passage of albumin

¹⁰⁹ Journal of the American Medical Association, November 9, 1918, p. 1568.

¹¹⁰ Ibid., December 14, 1918, p. 1962.

¹¹¹ Ibid., December 14, 1918, p. 1988.

¹¹² Ibid., January 4, 1919, p. 24.

¹¹³ Ibid., December 28, 1918, p. 2138.

¹¹⁴ Ibid., November 30, 1918, p. 1816.

¹¹⁵ British Medical Journal, July 27, 1918, p. 82.

¹¹⁶ Ibid., November, 23, 1918, p. 566.

¹¹⁷ Journal of the American Medical Association, May 17, 1919, p. 1457.

¹¹⁸ La Semana Medica, April 17, 1919, p. 406.

through the kidney as well as irritation of the renal epithelium. The changes which take place are not only in the secreting portion of the kidney, but also in the glomeruli. The clinical picture produced is that of an absolute functional insufficiency of the kidney,—anuria, general edema, ascites, vomiting and symptoms of uremic poisoning.

I have seen one instance of very remarkable nephritis supposed to have followed influenza in which the anuria was followed by a prolonged period of very scanty urine, the total output varying from four to eight or ten ounces a day. This condition persisted for many months, and strange to relate, after the initial symptoms had disappeared, there were practically no symptoms connected with the diminished output.

RUPTURE OF THE RECTUS ABDOMINIS. I have commented elsewhere on the changes taking place in the rectus abdominis in influenza. A case illustrating this very well indeed is reported by Baggins.¹¹⁹ The patient was a boy of eleven, who had had influenza for six days when he developed septic bronchopneumonia. He suddenly developed acute pain and tenderness in the iliac fossa and the diagnosis of appendicitis was made. There was vomiting and operation was advised. The sheath of the rectus was found to be torn completely across. There was no extravasation of blood, but the muscle was pulpy and friable under the finger. The most important points about this case was the great dilatation of the superficial veins of the abdomen and thorax, and the total absence of bleeding during the operation. The appendix was not very much affected, and the patient eventually recovered entirely.

GAS IN THE FASCIAL TISSUES. Among the various curious things noted in the epidemic were certain cases of emphysema of the tissues. Clark and Synnott¹²⁰ have reported 12 instances. The gas, as they call it, they believe to be air from the lung which was distributed as one of the purely mechanical factors. Some of the cases recovered, and in the ones that came to necropsy no bacteria were recovered from the inflated parts.

PREGNANCY COMPLICATED BY EPIDEMIC INFLUENZA. This subject received a very considerable amount of attention, inasmuch as influenza, and pneumonia are extremely grave complications of the pregnant state. This is no new fact, but was commented upon after the epidemic of 1890 and had been noted by various writers in previous epidemics. Among the various contributions on this subject are those by Farrar,¹²¹ Kosmak¹²² Bland,¹²³ Woolston and Conley,¹²⁴ and Titus and Jamison.¹²⁵ The last-named authors have studied about 50 cases of pregnancy complicated by epidemic influenza. A large proportion of these miscarried or fell into labor prematurely or otherwise, as a direct result of the infection, and the mortality was markedly increased. Perhaps no class suffered as severely as regards mortality as the pregnant women. There is a

¹¹⁹ *Lancet*, May 17, 1919, p. 843.

¹²⁰ *American Journal of the Medical Sciences*, February, 1919, p. 219.

¹²¹ *American Journal of Obstetrics*, 1919, lxxix, 229.

¹²² *Ibid.*, p. 238.

¹²³ *Ibid.*, p. 184.

¹²⁴ *Journal of the American Medical Association*, December 7, 1918, lxxi, 1898.

¹²⁵ *Ibid.*, June 7, 1919, p. 1665.

difference of opinion regarding the influence of abortion. Bland has called attention to the fact that 75.5 per cent. of the women in whom the disease was fatal died after their pregnancy was interrupted, but Arnold,¹²⁶ in discussing this, stated that abortion or miscarriage was not to be feared, but welcomed and considered artificial termination of pregnancy advisable in order to lessen the toxemia of the patient. Farrar and Kosmak believe that abortion has little or no influence on the course of the disease, although the latter author believes that the induction of labor should not be undertaken as it simply increases the burden for the patient. In the 50 patients of Titus and Jamison, in 21, or 42 per cent., the pregnancy was interrupted as a direct result of the infection. Seventeen of these died, a mortality of 80.9 per cent., and of 29 whose pregnancy was undisturbed, 14, or 48.2 per cent., died undelivered, whereas the remaining 51.8 per cent. recovered without any apparent effect on their pregnancy.

The mechanism with which the disease disturbs pregnancy is believed to be a combination of factors, such as the deoxygenation of the blood, excessive accumulation of carbon dioxide in the blood, and a toxemia sufficient to cause the death of the fetus. In the later months, the first two conditions may be sufficient to start labor, but in the earlier months the death of the fetus is usually required to start uterine contractions. The bad effects of abortion or labor in the course of the disease have been explained on the ground of increased muscle exertion causing an excess of carbon dioxide in the blood and adding a great strain on the already weakened heart.

The sudden release of intra-abdominal pressure in advanced pregnancy and the sudden drop of blood-pressure by hemorrhage incident to labor, and the lessened resistance to the ordinary shock of labor and delivery are given as contributory factors.

The *treatment of pregnant women* during influenza epidemics is to avoid as far as possible all exposure to the disease or to pneumonia or even common colds, and in case the patient is infected place her at absolute rest in the fresh air, start stimulation early, avoid violent purging or the use of quinine, see that elimination is free, and use sedatives as required. Titus and Jamison believe that if labor or miscarriage starts, an early interference is advisable to avoid the strain of the second stage. They advise forceps delivery as soon as the cervix is dilated. Anesthesia is contra-indicated and not required, inasmuch as the patients are usually so toxic as to be indifferent to the pain. Care should be taken to prepare to deal very promptly with hemorrhage. If extra fluid is necessary, they believe in injecting it subcutaneously rather than run the risk of overloading an already strained circulatory system.

PROPHYLACTIC INOCULATIONS. Rosenow and Sturdivant¹²⁷ give the results of some of their work on prophylactic inoculations. They¹²⁸ had previously reported that the streptococci, especially green-producing ones from influenza, have certain peculiar properties, and vaccines made

¹²⁶ American Journal of Obstetrics, 1919, lxxix, 304.

¹²⁷ Journal of the American Medical Association, August 9, 1919, p. 396.

¹²⁸ Ibid., January 4, 1919, p. 31.

of this organism were used; they claim that considerable protection is afforded against influenza and especially against the accompanying pneumonia. The vaccine which they used in most of their cases was made up of pneumococci Types I, II and III, 30 per cent.; Type IV, 40 per cent., hemolytic streptococci, 20 per cent., and *Staphylococcus aureus*, 10 per cent. These were suspended in oil.

They believe that this vaccine contains the important factors as they occur in influenza and the accompanying pneumonia. The vaccine was used in various localities and in some communities the mortality rate was excessively high, and in others comparatively low. Their study included a period of from three to seven months. The average mortality in the uninoculated approximates the mortality rate of 5.4 per cent. of sixteen large cities of the United States, as given in the Public Health Reports for February 7. The average mortality rate in the inoculated three times is about one-fifth of that of the uninoculated. A definite, though smaller, degree of protection appeared to be afforded to those who took only one or two inoculations. From a study of a series of hospital cases of influenza, it was found that the tendency to develop pneumonia in the vaccinated is about one-third as great as in the unvaccinated, and that the mortality in the former is about one-fifth as great as in the latter.

THE USE OF CONVALESCENT BLOOD SERUM IN THE TREATMENT OF INFLUENZAL PNEUMONIA. There have been a considerable number of reports dealing with this subject, among which may be noted those of McGuire and Redding,¹²⁹ Fell,¹³⁰ Rood,¹³¹ Lamb and Brannin,¹³² Ross and Hund,¹³³ Lewisohn,¹³⁴ Pemberton,¹³⁵ O'Malley and Hartman,¹³⁶ Lesné,¹³⁷ and Stoll,¹³⁸ and these represent only a few. For the most part the reports are favorable. Rood, however, considers it to be without value. Stoll believes that the transfusion of normal blood or serum is only exceptionally of value in influenzal pneumonia and that the blood of individuals vaccinated against pneumococcus Types I, II and III possesses no advantage over normal blood in this type of the disease. His opinion is that too few persons were treated with convalescent serum to warrant definite conclusions, but the impression received was that it was less potent than convalescent pneumonia serum, but of more value than normal serum. While it may be of value up to the fifth day of the disease, when used early, within the first three days, there was a distinct improvement in the majority of cases. It seems to lower the mortality, shorten the course of the disease and diminish complications; and these opinions may be taken to be those of most of the workers who have reported on this subject.

¹²⁹ Journal of the American Medical Association, October 19, 1918, p. 1311.

¹³⁰ Ibid., June 7, 1919, p. 1658.

¹³¹ New York Medical Journal, March 22, 1919, p. 493.

¹³² Journal of the American Medical Association, April 12, 1919, p. 1056.

¹³³ Ibid., March 1, 1919, p. 640.

¹³⁴ American Journal of the Medical Sciences, February, 1919, p. 253.

¹³⁵ Surgery, Gynecology and Obstetrics, March, 1919, p. 262.

¹³⁶ Journal of the American Medical Association, January 4, 1919, p. 34.

¹³⁷ Presse médicale, April 7, 1919, p. 181.

¹³⁸ Journal of the American Medical Association, August 16, 1919, p. 478.

McGuire and Redden¹³⁹ have made two reports on this subject and a very remarkable showing. The immediate result of the use of the serum may be a chill in about thirty minutes after the injection, but after a few hours the patient shows decided signs of improvement, the toxic symptoms subside, nausea and vomiting, if present, cease, the headache disappears and likewise the vasomotor disturbances. The expression of the patient is changed from that of one very ill to one convalescent.

The procedure is very simple. Wassermann tests were done on all patients admitted with pneumonia and later, when the blood is to be used, 500 c.c. are taken at two succeeding bleedings with an interval of a day or two. The blood is generally taken about ten days after the temperature has reached normal. Some was taken earlier than this, while six weeks was regarded as the longest time in which it ought to be taken. In one experience the blood was obtained from a man who had been well for from six to eight weeks and the potency was manifestly lowered. The blood is allowed to remain in the incubator at body temperature for an hour shortly after it is collected. By this time, if serum is needed urgently, about 100 c.c. can be obtained from each 400 or 500 c.c. of blood. This is decanted and centrifugalized and all serum obtained is pooled. To this is added 20 c.c. of 1.5 per cent. tricresol made up in normal salt solution for every 100 c.c. of serum. This is then separated into 120 c.c. amounts and stored. Serum prepared in this way has been used with excellent results six weeks or later. It is important to know that frequently what appears to be fat accumulates on the surface of the serum; this goes into solution on heating to body temperature, and is apparently of no significance.

The serum is given intravenously, about ten minutes being taken to give the dose and as high as 250 c.c. have been given at one time. The results obtained were very significant. Out of 151 patients with bronchopneumonia following influenza, 3 died without complications and 3 more died after a complicating hemolytic streptococcus empyema, making a total of 4 per cent. Most of these cases were treated early and hence were well suited for serum treatment. Out of the 151 cases, 132 received three doses of the serum or less, about two-third required only two doses, and over one-third but one injection. Those who received more than one injection had, for the most part, advanced to at least two days in their pneumonia. The average dose was 120 c.c.

Out of 138 patients, 83 recovered by crisis and 55 by lysis. In 148 cases over one-half showed a normal temperature within twenty-four hours after the beginning of the serum treatment. The period of pyrexia was decidedly shortened, but lung signs persisted. A bronchopneumonia with a white blood count below 10,000 or 12,000 was found most suitable for the treatment, although a number with much higher counts responded.

These are among some of the best results obtained during the epidemic of influenza without regard to the form of treatment.

NON-SPECIFIC PROTEIN THERAPY IN INFLUENZAL PNEUMONIA. When one considers the points brought out by Wright, given in this review

¹³⁹ *Journal of the American Medical Association*, October 19, 1918, p. 1311, and March 8, 1919, p. 709.

under the title of *Lessons of the War*, then the work of Cowie and Beaven¹⁴⁰ takes on a very considerable interest. These authors had had experience with the treatment of arthritis and other infections by the intravenous injection of the typhoid protein, and from their results thought that this method of treatment in influenzal pneumonia might be of value, particularly in stimulating polymorphonuclear leukocyte production. Their procedure, after some observations, was to use half a billion dead typhoid bacilli. They found that this gave as much beneficial effect and was not as liable to cause as much reaction as larger doses. If more than one dose was given, at least a day should intervene. Using this dose, they believe that the intravenous injection of typhoid protein in influenzal pneumonia is a safe form of treatment and that it is indicated only in the beginning stage of pneumonia. They believe that the use of this method of treatment is contra-indicated in cases of influenzal pneumonia advanced beyond the third day of the disease, or when there is undoubted evidence of advanced myocardial insufficiency, or acute endocarditis. The immediate effects of the foreign protein is the development of a typical protein paroxysm, which is followed by a marked decrease in the temperature and a definite improvement in the subjective symptoms, both of which are usually permanent. There is also a characteristic leukocyte movement. In the cases studied this was only of a moderate degree and there was no permanent improvement in the leukopenia. The effect on the pulse, respiration and physical signs was practically negligible. They conclude that an intravenous injection of typhoid protein may bring about a termination of the acute symptoms of the disease in from one to three days.

SELECTIVE MEDIUM FOR THE INFLUENZA BACILLUS. Avery¹⁴¹ has found that it is possible, by the use of special medium, to demonstrate the influenza bacillus in a very much greater percentage than with the media in ordinary use. This medium is also favorable for the *Micrococcus catarrhalis* and *staphylococcus*, while pneumococci and streptococci of the hemolytic and viridans variety did not develop. The medium contains 94 c.c. agar, 5 c.c. of a 2 per cent. solution of sodium oleate, and 1 c.c. of suspension of red blood cells.

Measles. BACTERIA IN THE SPUTUM IN MEASLES. In 1917, Tunncliffe¹⁴² described a small gram-positive diplococcus which was isolated from the blood, eye, ear, nose and throat of measles patients. The organism was cultivated only in anaërobic cultures from the blood, but generally grew aerobically in the second generation. Diplococci could be cultivated readily from the throat on aerobic blood-agar plates, probably due to the presence of other organisms, and diplococci corresponding morphologically to those in cultures could be demonstrated in smears made from the tonsils and anterior pillars.

Seventeen specimens from measles patients at Camp Meade, Maryland, were studied, and the diplococci isolated from the sputum of all. Some studies on the increased opsonic power of the blood of rabbits immunized with these organisms were also made.

¹⁴⁰ *Journal of the American Medical Association*, April 19, 1919, p. 1117.

¹⁴¹ *Ibid.*, December 21, 1919, p. 2051.

¹⁴² *Journal of Infectious Diseases*, February, 1919, p. 181.

Whether this organism is merely an accompaniment of measles, or has something to do with its etiology, is not clear. It seems strange that a disease as common as measles has such comparatively few studies made on it as regards its etiology.

THROAT CULTURES IN MEASLES. Some interesting observations on this point have been made by Knowlton.¹⁴³ Routine cultures were made in each case of measles as soon after the patient entered the ward as possible. This was done for the purpose of selecting the carriers of hemolytic streptococci. Knowlton tabulates the records of 458 cases and the chief interest lies in the relation of the throat organisms and the principal complications, that is, pneumonia and otitis media. There were 13 deaths, or a mortality of 2.7 per cent. There were 48 cases of pneumonia, in 10 of which there was an empyema, the hemolytic streptococcus being the predominating organism. Six of these patients died. There were 43 cases of suppurative otitis media, with 5 cases of mastoiditis. There were also noted 3 of frontal sinusitis; 2 of peritonsillar abscess, and one of acute appendicitis. Curiously enough, in this series, pneumonia and otitis media occurred in the same proportion in the streptococcic as in the non-streptococcic throats. These figures do not coincide with those of Levy and Alexander.¹⁴⁴ Knowlton believes that abundance of fresh air and plenty of space is the largest one factor in preventing complications in these measles cases.

EXPERIMENTAL MEASLES. As early as 1758, Francis Home, in Edinburgh, tried to transmit measles in order to have patients have the disease in a "gentle and favorable degree," hoping thereby that persons so inoculated would be "preserved from that malignant sort which often proves mortal, and is always dangerous." His procedure was to take the blood from measles patients on cotton and place it inside the wound in the arm of the person to be inoculated where it remained for three days. These attempts of Home and an account of other early observations of this nature are given by Hektoen.¹⁴⁵ This same observer¹⁴⁶ has given a further review of observations that have been made on this subject. In most instances there has been some doubt as to the reproduction of the disease. It will be remembered that Hektoen himself reported, in 1905, transmission of the disease by taking 3 c.c. of blood from a measles patient on the first day of the rash and mixing it with 50 c.c. of ascites broth, and after an incubation of twenty-four hours at 37° C., 4 c.c. of this mixture were injected subcutaneously. This and a somewhat similar procedure were used in 2 cases, both of which were supposedly successful. From this he concluded that the virus of measles was present in the blood at least during the first thirty hours of the rash.

More recently, Herrman¹⁴⁷ made some observations in 40 infants under five months of age. Taking nasal mucosa from patients having measles twenty-four hours before the eruption, he rubbed it gently on the nasal mucous membrane of the child. Fifteen of these had a rise

¹⁴³ Journal of the American Medical Association, May 24, 1919, p. 1524.

¹⁴⁴ Ibid., June 15, 1918, p. 1827.

¹⁴⁵ Journal of Infectious Diseases, 1905, No. 2, p. 238.

¹⁴⁶ Journal of the American Medical Association, January 18, 1919, p. 177.

¹⁴⁷ Archives of Pediatrics, 1915, xxxii, 503.

of temperature in from eight to fourteen days, and in a few instances there were a small number of indistinct spots noted on the face and body between the fourteenth and eighteenth days. When these children became more than a year old, four of them came in intimate contact with measles without becoming sick, and when they were twenty-one to twenty-three months of age, two of them were reinoculated without producing measles.

Hektoen also outlines the observations that have been made upon animals. The only animal that can be used is the monkey, the others seemingly are immune. This susceptibility in the monkey is variable and not very marked. The disease is mild, and, after an incubation period of several days, there is fever, which may be associated with more or less typical symptoms—respiratory symptoms, Koplik's spots and the characteristic leukopenia. Observations on monkeys show that the virus of measles is present in the nasopharyngeal secretions and the blood at least twenty-four hours before the rash, as well as for a day or two afterward. From the human observations one may conclude that the virus is present in the nasal secretions, scrapings of the skin, epithelial debris and blood, and the blood during the early part of the eruptive stage. Hektoen states that attempts to produce a mild, modified or localized form of measles by inoculation have not yet given conclusive results.

ARTIFICIAL IMMUNITY IN MEASLES. Of interest in this connection are observations made by Richardson and Connor.¹⁴⁸ Their observations were preceded by those of Nicolle and Conseil¹⁴⁹ using convalescent serum. They used a serum from a child, the first case in a family of four children. Two of the other children were not treated, but a child two years of age was given serum from the first case, taken on the seventh day of convalescence and ten days after the first symptoms. The other two children came down with measles in three or four days, but the two-year-old escaped, although exposed to the first child and later to his two brothers.

Richardson and Connor used two methods. One, the convalescent serum alone, and the second, the simultaneous inoculation of the patient with both virus and immune serum. In the first instance the blood was withdrawn from the veins on the flexor surface of the elbow and collected in sterile test-tubes. These were placed in a refrigerator overnight and then the serum decanted into test-tubes. The Wassermann reaction was made with each serum. The serum was kept in the ice-box a week at most without a preservative; when it was kept longer a 0.25 per cent. solution of tricresol was added. From 7 to 25 c.c., usually in a single dose, were injected intramuscularly into the thigh within a few days of exposure and there were no reactions, either local or general. In the first group of patients, four in number, these children had not had measles, but were exposed in a ward. Three were given a serum and one not. The ones having the serum did not develop the disease while the control did. In the second group were two children who were

¹⁴⁸ Journal of the American Medical Association, April 12, 1919, p. 1046.

¹⁴⁹ Bull. de la Soc. méd. d. hôp. de Paris, April 12, 1918.

exposed. Both were given the serum and both escaped the disease. Of the third group there was one child who had never had the disease, but was exposed; when given the serum did not develop it.

There were also some observations made with patients who were partially exposed to the disease, that is, in large wards where the beds were far apart and aseptic precautions taken to prevent the spread of the disease. Three patients were treated by the second method, that is, both the virus and convalescent serum. In two, there was no reaction; in the third there was a slight reaction indicated by a transient rise in temperature and an atypical rash.

These observations are, of course, too few to warrant any definite conclusions, but point out the fact that it may be possible to develop a practical method of immunizing children against measles. It would seem to be necessary in this to develop some source of material other than the human being if the method is to be used upon any very large scale.

INSUSCEPTIBILITY OF MAN TO INOCULATION WITH BLOOD FROM MEASLES PATIENTS. Sellards¹⁶⁰ reopens this question by recording eight successive negative inoculations. While the failure to transmit in this manner does not necessarily exclude the possibility of the occurrence of the virus of the disease in the circulating blood; some evidence was obtained of the possibility of producing active immunity by the injection of the patient's blood. The injections were made with blood serum from the preëruptive stage, from the defibrinated blood, from the eruptive stage, citrated blood from the preëruptive stage, mucous secretions from the preëruptive stage, and blood from the eruptive stage were incubated in broth. Skin lesions and various methods of inoculation were used, as subcutaneous, intravenous, on the mucous membrane, intramuscularly and sometimes two of these combined.

Sellard's discussion of the subject is interesting. He points out that there are some diseases that can be readily transmitted from infected to susceptible individuals by the injection of blood, such as yellow fever, malaria and trench fever. Hektoen concluded that the same was true of measles. To appreciate the importance of this it must be borne in mind that for trench fever, malaria, and yellow fever, the natural portal of entry is through the skin, while in measles the portal of entry is in the mucous membrane. By changing the portal of entry of a given virus, remarkable changes may be produced, even on a highly susceptible host, as the vibrio of Asiatic cholera produces the diseases when it enters the body through the alimentary tract, but large amounts of living and virulent cultures can be injected into the skin with impunity.

Sellards gives some general rules concerning fundamental principles involved in the artificial immunization against any given infection. First, for those infections in which the mucous membrane constitutes the portal of entry and in which the classical lesions of the disease are not generally limited to the tissues accessible by direct continuity, the causative organism may be injected subcutaneously in a viable condition

¹⁶⁰ Bulletin of the Johns Hopkins Hospital, September, 1919, p. 257.

in moderate dosage with impunity. Second, as a corollary to the first statement, when the natural portal of entry of a pathogenic organism occurs through the skin, then artificial injection into the tissues or blood stream causes an infection which produces a typical manifestation of the spontaneous disease. In this class are bubonic plague, tetanus, glanders, anthrax, malaria, trypanosomiasis, hydrophobia, kala-azar, relapsing fever, typhus fever, yellow fever, dengue fever, trench fever and Rocky Mountain spotted fever. That subcutaneous or intramuscular injection of the virus in virulent form reproduces the typical features of the disease has been proved definitely in plague, malaria, yellow fever, trench fever, typhus and probably dengue. Third, for those infections in which the virus enters by way of the mucous membrane and gives rise to metastatic lesions in other tissues of the body, the injection of the virus into the body tissues usually produces the infection. In some instances the essential clinical characteristics of the disease are duplicated, but in others a modified infection occurs quite unlike the spontaneous disease. The meningococcus, *Micrococcus melitensis*, *Treponema pallidum* and the causative organism of poliomyelitis may be considered together. The injection of monkeys with the virus of poliomyelitis, and the accidental injection of man with the *Treponema pallidum* have produced typical infections, and doubtless similar results could be obtained with the meningococcus and *Micrococcus melitensis*. When the virus of smallpox is inoculated on the skin, instead of on the mucous membranes, smallpox inoculata develops and the disease as it occurs spontaneously cannot be produced in this manner. Hess and Unger have shown that the virus of chicken-pox when injected intravenously gives rise to no symptoms, but apparently produced some immunity.

Sellards also calls attention to the clinical phenomena of the rash on the upper part of the body and on the face with its gradual progress downward requiring from one to three days to complete this march, and this is quite unlike the development of eruptions in which the virus is known to be distributed by the circulating blood.

The failure to transmit the disease by injection of the blood does not preclude the existence of the virus in the blood stream even in moderate amounts, and Sellards points out that these men not only failed to become infected, but that they were actively immunized by the injection of the blood. Such an assumption would, of course, presuppose the existence of the virus in the blood stream, and indeed the agent which excites the rash might readily gain access, at least temporarily, to the blood stream, regardless of the fact whether its distribution takes place through the lymphatics or by the circulating blood. Sellards believes that, with appropriate isolation of the virus, a substantial active immunity should be obtainable with a minimum of inconvenience to the individual.

THE INSUSCEPTIBILITY OF MONKEYS TO INOCULATION OF BLOOD FROM MEASLES PATIENTS. In connection with the observations made on man, the studies of Sellards and Wentworth¹⁵¹ are of particular

¹⁵¹ Johns Hopkins Hospital Bulletin, March, 1919, p. 57.

interest. Their studies were made with the view of seeing if the virus of measles could be attenuated in such a manner that it would be suitable for prophylactic purposes. A variety of bacteria have been cultivated from the blood and mucous exudates of patients, but no evidence has been brought forward to show that any of them have anything to do with the etiology of the disease. Reviewing the literature of the work of other observers, it was found that a number of reports have been made on the susceptibility of the monkey, the symptoms produced being rash, Koplik's spots, fever, leukopenia, rhinitis and malaise, and significant or clearly marked results were reported for all monkeys injected with the blood taken from unquestionably early cases of measles, that is, within from twelve to twenty-four hours after the appearance of the rash. After the second day of the rash the results were doubtful or negative. Observations were made on the *Macacus rhesus*, *M. cynomolgus* and *M. sinicus*. Nicolle and Conseil, Hektoen and Eggers, and Lucas and Prizer have all obtained what they regard as positive results and also the transmission of the disease from monkey to monkey by the inoculation of the blood. Anderson and Goldberger have succeeded in passing it through six successive passages without any change in the virulence. Sellards and Wentworth inoculated three monkeys with the blood taken early in the course of the disease in moderately severe cases. All of the animals remained free from any symptoms and two of them injected a second time also failed to develop any symptoms. After an incubation period of eleven days, blood was taken from one of these monkeys and injected into a human volunteer, but no symptoms developed.

Cerebrospinal Fluid in Acute Disease. Considering the importance of this subject, it is curious how comparatively few observations have been made. The observations of Herrick and Dannenberg¹²² are therefore of particular interest and should be consulted by anyone interested, as their article contains references to the principal articles in the literature. Flexner and Amos have shown that the choroid plexus acts as a barrier to the passage of the virus from the blood to the central nervous system and also that the barrier is broken down under the influence of inflammation excited either mechanically or chemically, and this same principle applies to other infective agents, as Austrian and others have shown that in infections with the meningococci subarachnoid injections, or lumbar puncture may increase the permeability of the choroid plexus and so lead to a localization in the meninges. Viton and others have shown that similar conditions govern the permeability for chemical substances. There are some differences of opinion regarding these points. There are various opinions held by different observers on the character of the cerebrospinal fluid findings in different conditions of disease. Some observers have found changes in the cerebrospinal fluid and others have not. The conditions definitely not meningitis are usually grouped under the term "serous meningitis," or perhaps better, meningismus, and unfortunately it has been the practice in many of these cases to disregard the study of the cerebrospinal fluid if it is clear

¹²² Journal of the American Medical Association, November 1, 1919, p. 1321.

unless meningitis or poliomyelitis is suspected. DuBois and Neal described the cerebrospinal fluid as increased in amount and containing very few cells with a globulin reaction of +. Some observers believe there is no essential difference between the pathogenesis of purulent meningitis and a serous meningitis, and examination of the cerebrospinal fluid is a means of determining the degree of the process. Lucas, some years ago, called attention to the non-specificity of the cerebrospinal fluid in various meningeal conditions. Plaut, Rehm and Schottmüller make a statement that lobar pneumonia, pertussis, scarlatina, measles, mumps, typhoid, and sepsis with cerebral symptoms may have a cerebrospinal fluid under heightened pressure with globulin and an increase in the cells, sometimes the increase running into several hundred in the cubic millimeter.

Some studies have been made on the cell findings in various diseases. Lobar pneumonia is made the subject of a collective investigation by Voisin, including the literature up to 1904, and including lumbar punctures in 45 cases of bronchopneumonia with meningeal symptoms. All but one of these cases had purulent otitis media, but only 8 showed an increase in cells, the variations being from 11 to 66 per cubic millimeter. Voisin also reported 64 punctures in 38 cases, most of which had suppurative otitis. In 15, the fluids were normal; in 23, there were some changes, and, in 19, more or less marked leukocyte reaction. Sixty per cent. showed the presence of albumin. Voisin believes that the changes may vary from a slight increase in pressure to a purulent fluid.

Litchfield stated that only in rare exceptions did cases with meningeal irritation show normal fluid, and reiterates what has been found true in meningococcus meningitis, that a clear fluid may be obtained by lumbar puncture, although there is irritation at the higher levels.

In scarlet fever, Hutinel found that when there was an associated meningismus there was often a lymphocytosis of the spinal fluid and suggested that these changes might be brought about by a tendency to the invasion of the cerebrospinal and cerebral coverings in the same manner as the skin, applying this not only to scarlet fever but to the other exanthemata. Sharpe has reported a case of scarlet fever in which the cerebrospinal fluid was under great pressure and obtained globulin, which, at autopsy, showed an edema of the leptomeninges. Other authors have also noted slight increases in the cell count, the increase being mostly the lymphocytes.

In mumps, in which there are meningeal symptoms, there may be an increase in the cells, even to the point of turbidity. Such cases have been reported by Chauffard and Boidin, and Larkin, and Monod. This whole subject has been summed up by Acker.¹⁵³

Meningismus in influenza is of common occurrence and cases of this kind, with an increase in cells and cerebrospinal fluid, have been reported, and these cases have also recovered without any untoward result. In the gastro-enteritis of children there may be cerebrospinal fluids resembling those found in tuberculous conditions. Changes have also been observed in rabies, Malta fever, diphtheria with paralysis,

¹⁵³ American Journal of Diseases of Children, 1913, vi, 399.

tetanus, plague, malaria, trypanosomiasis, as well as other conditions not due to infection, as uremia, alcoholism, saturnism, and herpes zoster. The personal observations of Herrick and Dannenberg are the results of a by-study of the early phases of meningococcus meningitis at the Base Hospital, Camp Jackson, South Carolina. In an attempt to recognize this disease in the premeningitic state of meningococcus sepsis, many other acute infections with meningismus were under suspicion, and lumbar puncture was done in over 100 of such cases. Counts and globulin estimations were made by competent individuals having no knowledge of the cases studied. The observations did not include any case in which there might be changes in the central nervous system, such as poliomyelitis, meningitis, mastoiditis, syphilis, etc. Their study includes 76 cases of meningismus which did not result in meningitis at any stage. There did not seem to be any constant relation to the symptoms with the reaction in the spinal fluid and the study of the relation of the subarachnoid reaction to the leukocyte reaction of the blood was also negative, many cases with pronounced leukocytosis being met with in which there were no significant changes in the cerebrospinal fluid, and *vice versa*. The findings had no prognostic value except in rare instances in which an oncoming meningitis was indicated.

Their findings in the various acute diseases are interesting. In 12 cases of bronchopneumonia, 7 gave a cellular reaction of from 12 to 200 cells, and 8 had a globulin increase. In 14 cases of bronchopneumonia, 5 showed an increase in cells varying from 12 to 30. In 14 cases of influenza with meningismus, all of which recovered, 5 showed a pleocytosis of from 14 to 40 cells, and 3 had a globulin increase. Their details of the other findings may be omitted, but it is interesting to note what the authors have to say in regard to poliomyelitis.

"Of the more doubtful etiological agents of infections, that of poliomyelitis penetrates the structures in question with the highest facility. The virus or toxins of scarlet fever, of measles, parotitis, variola, epidemic influenza may give rise to reaction within the subarachnoid. That many of these viruses are filtrable, is perhaps not without significance. All this has diagnostic value, both positive and negative.

"It is obvious that it is unsafe to rely too greatly upon the presence of a slight or moderate increase in cells or globulin in the cerebrospinal fluid in the diagnosis of meningitis or poliomyelitis. The terrorization of families or communities by the diagnosis of these serious infections, from the mere presence of fever, meningismus and the spinal findings mentioned, is not justifiable. Abortive poliomyelitis is a dangerous diagnosis, and, until the recognition of the etiological agent has been placed on a basis useful clinically, had best be made with the greatest caution. Cases with less than 100 cells in the cerebrospinal fluid and without paralysis, should be viewed with skepticism, in the absence of very strong epidemiological, clinical or immunological evidence."

The authors do not take much stock in recent statements about the dangers of lumbar puncture. In an experience with some 5000 cases of this character in all sorts of medical conditions, nothing occurred to deter them from their examinations and they believe that until convinc-

ing clinical proof is at hand, the skilled clinician need have no hesitation in removing 5 to 8 c.c. of cerebrospinal fluid through a small needle drop by drop. They believe that the removal of any larger amounts, except for therapeutic purposes in meningitis, is unwise. They believe that the heightened pressure in the subarachnoid system, in the early stage of so many infections, may well be a protective reaction, and care must be taken not to reduce this to the point of promoting undesirable filtration from the blood stream. They state that there is clinical evidence at hand tending to show that the meningeal choroidal complex consolidates its defenses after sepsis has existed for some time, and that the release is fraught with less danger at a later than at an earlier period of sepsis.

Their conclusions may be quoted as follows:

"1. Review of the literature and personal study of 76 cases not resulting in meningitis, show beyond question that the cerebrospinal fluid often gives evidence in increased pressure, pleocytosis and heightened globulin content of a reaction on the part of the leptomeninges to the infective agents or toxins of a large number of miscellaneous acute diseases, not ordinarily causing true meningitis.

"2. These diseases are lobar and bronchopneumonia, influenza, tonsillitis; the exanthemata, scarlet fever, measles, variola; herpes zoster, parotitis, enteric fever, sepsis, arthritis, pleurisy, migraine, reaction to typhoid inoculation and others.

"3. The cerebrospinal fluid shows variation from the normal in about one-third of the cases studied.

"4. Most, but by no means all, of the cases with subarachnoid reaction have clinical meningismus (Meningitis serosa, Dupre). On the other hand, many examples of meningismus are without pronounced changes in the cerebrospinal fluid.

"5. The greatest caution should be used in making a diagnosis of meningitis or poliomyelitis from fever, meningismus and the changes in the cerebrospinal fluid mentioned. Cases with less than 100 cells should be viewed with skepticism, unless clinical, epidemiological or other laboratory evidence is decisive."

Meningitis. THE PRODUCTION OF MENINGITIS BY THE RELEASE OF CEREBROSPINAL FLUID. Some very interesting observations have been made on this subject by Weed, Wegeforth, Ayer and Felton.¹⁴⁴ Without going into the details of their observations, which were made on cats, it may be stated that they found that, using a virulent strain of *Bacillus mucosus capsulatus*, they were able to obtain a meningitis by injecting the organisms into the circulation and during the experimental septicemia so produced withdrawing the spinal fluid. The inflammation was probably caused by the organism getting into the meninges, either as the result of infection due to a possible leakage of blood along the track of the needle into the subarachnoid space, or, what is more probable, that it is due to alterations in the pressure of the spinal fluid, and this conclusion seems to be borne out by the fact that in the majority of cases it was found that the exudate was largely cerebral and did not

¹⁴⁴ Journal of the American Medical Association, January 18, 1919, p. 190.

seem to spread from a local point of infection. The withdrawal and replacement of the fluid just before intravenous inoculation did not result in the production of a meningitis, although it was impossible to prevent leakage of fluid outward along the path of the needle; and also for the reason that the withdrawal of the fluid with replacement after two minutes does not prevent the development of a meningitis.

These observations have a very great and direct interest, inasmuch as it would seem that it would be possible to set up a meningitis in septicemia in man by withdrawing the cerebrospinal fluid for the purpose of observation. The work of Amoss, and others, on poliomyelitis, on which I commented in *PROGRESSIVE MEDICINE* for March, 1919, is of great interest in this connection. The authors are at present collecting data on the subject of whether the withdrawal of the cerebrospinal fluid during septicemia will cause meningitis in human beings. (See, also, *Extra-Meningeal Infections*.)

BLOOD FILMS IN THE EARLY DIAGNOSIS OF CEREBROSPINAL FEVER. It seems very strange that more attention has not been paid to the early diagnosis of cerebrospinal fever by examination of the blood with a view to demonstrating the meningococcus. If the view that the meningococcus passes to the blood from the mucous membrane of the nasopharynx and produces a primary blood infection to which meningitis is a secondary infection is correct, as a very considerable amount of material has been brought forward to show that it is, it would seem possible that a blood examination might be of service. Horder has done a work on this point in London, in 1915, and made the suggestion. King¹⁵⁵ has been able to demonstrate the organism in the case of a child, four and a half years of age. This should open up a field of research with a view of determining the possibilities of this method of diagnosis. The following article is of interest in this connection.

EXTRAMENINGEAL MENINGOCOCCUS INFECTIONS. Herrick¹⁵⁶ has written an article on this subject which is deserving of special attention. In this connection one may refer to some of his¹⁵⁷ previous work. There is some difference of opinion about meningococcus infections, but, in order to understand the cases clinically and to apply certain diagnostic methods and a sensible therapy, it is necessary to recognize that meningeal infections, most strikingly noticeable when they affect the meninges, should not be regarded only in the light of a meningitis. For this reason, in my opinion, the term cerebrospinal fever is to be preferred, and this has been used by Osler and other clinicians and is much better from the standpoint of teaching, inasmuch as it gives a better idea of the true state of affairs. Meningococcus infections are blood infections and for about forty-eight hours the organism causes a meningococcus septicemia, and it is very probable that there are such cases that get well without leaving any trace whatever and without any localized symptoms. When the localization is in the meninges, as it is apt to be, the disease is

¹⁵⁵ *Journal of the American Medical Association*, December 21, 1919, p. 2048.

¹⁵⁶ *Archives of Internal Medicine*, April, 1919, p. 409.

¹⁵⁷ *Journal of the American Medical Association*, January 26, 1918, p. 227; *Archives of Internal Medicine*, April, 1918, p. 54; *Journal of the American Medical Association*, August 24, 1918, p. 612.

easily recognized. When the localization is in some other part of the body, as in a joint, for example, the diagnosis may be incorrectly made.

Herrick had unusual opportunities for studying cases from the very hour of their beginning, some 315 patients with meningococcus infection being examined and in approximately 40 per cent. the diagnosis was made before meningitis developed, while in 5 per cent. meningitis never developed at all. With but few exceptions, the earliest evidences of meningitis were preceded by symptoms of a general infection lasting from a few hours to several days, and, in exceptional cases, weeks. This Herrick was able to prove repeatedly by blood culture, clinical studies, and autopsies.

An instance of meningococcus sepsis without meningitis is illustrated in the case of a private, twenty-one years of age, admitted to the hospital on September 28, 1918, with typical influenza. The temperature was 101° F., and there was headache, joint pains and cough, and coryza. On October 3, the temperature became normal, and remained so. Early on October 7 it was noted that the patient had a chill in the early part of the night with pain in the chest, was covered with perspiration, the general condition was very poor and the temperature subnormal. There were signs of bronchopneumonia at the base of both lungs. By 10 A.M. a petechial rash appeared, the spots rapidly increased in size and number and extended over the arms, trunk, face and conjunctivæ. The patient quickly sank into coma. There were no specific signs of meningitis, the spinal fluid was clear, contained no albumin, and showed 12 cells per cubic millimeter, but neither pus cells nor organisms. The patient was given antimeningococcus serum, but did not respond and died at 11.30 A.M., six to eight hours after the initial chill. Cultures from the spinal fluid and from the heart blood, taken immediately after death, showed meningococci. At death, the body was a mass of purpuric blotches. Examination of the brain showed that there was no gross lesion, cellular increase or exudate.

Pneumonia and pleurisy are common in meningococcus infections, both early and as complications later, and the organisms are often found in the sphenoid and ethmoid sinuses. Cleminson¹⁵⁸ believes that the accessory sinuses are the chief points of infection in meningococcus carriers. Herrick believes that the term epidemic cerebrospinal meningitis and meningococcus infection should be substituted, as suggested by Heiman and Felstein. The term that I mentioned above, cerebrospinal fever, would seem to be just as satisfactory an appellation and has the advantage of having more or less general use for a long period of time.

THE DETECTION OF MENINGOCOCCUS CARRIERS. A number of very good studies have been made on this subject, and among them is one by Schorer.¹⁵⁹ The steps in the examination are as follows:

1. Selection of those from whom cultures are to be taken.
2. Taking of cultures with the West tube.
3. Inoculation of veal glucose serum agar.

¹⁵⁸ British Medical Journal, July 20, 1918, p. 51.

¹⁵⁹ Journal of the American Medical Association, March 1, 1919, p. 643.

4. Selection of colonies.
5. Identification of organisms by:
 - (a) Morphology in stained specimens.
 - (b) Agglutination tests (polyvalent serum and normal horse serum).
 - (c) If found to be meningococci, agglutination tests with the various monovalent type serums.

Schorer believes that by using this method, which he did on a very large number of soldiers, it is possible to detect the carriers, and this is a very much better method than trying to quarantine all the contacts. The best results are obtained by taking cultures of the whole organization rather than making studies only of those thought to be contacts. Some idea of the number of cultures necessary may be gained from the fact that they ran into four or five thousand a week, sometimes up to two thousand at a time. The cultures were taken even of an entire camp without interfering with military training and it was found that taking out the carriers and putting them in a carrier camp interferes less than quarantining only the contacts. Schorer believes that this method should be used in troops that have come from areas where epidemic meningitis is endemic. He found no evidence that chronic carriers develop the disease, but it was shown that those that were afterward affected were in the incubation period when the cultures were taken. In making a large number of cultures, the use of a cotton swab on a straight wooden applicator, making the application through the nose into the nasopharynx, gave better results and is more feasible than the West tube.

PNEUMOCOCCUS MENINGITIS AND ITS TREATMENT BY SERUM. There is a general impression that pneumococcus meningitis is generally, although not always, fatal. Litchfield¹⁶⁰ had the opportunity of treating 10 cases of typical pneumococcus meningitis with the Kyes serum (Chicago). The diagnoses in all cases were proved both clinically and in the laboratory. Of these, 5 died and 5 recovered. Some of the patients with the most intense symptoms of meningitis recovered. In addition to the serum the patients were treated in the open air, with the usual routine of digitalis and other medicaments as indicated. The serum was given daily intravenously and intraspinaly. The doses varied from 5 to 10 c.c. The patients had recovered almost completely at the time of the report, although one still showed slight enlargement of the retinal veins and a very slight swelling of the discs. The other patients were practically normal.

These results are by far much better than those obtained by any other method of treatment, so that in the presence of either epidemic or sporadic cases of pneumococcus meningitis this method is to be recommended. Unfortunately, the type of pneumococcus is not given.

THE CHRONIC FORM OF MENINGOCOCCUS MENINGITIS. Gordon¹⁶¹ has made a report of 10 cases which showed that with a prolonged course there may be two varieties, one in which there are recurrences or episodic

¹⁶⁰ Journal of the American Medical Association, May 10, 1919, p. 1345.

¹⁶¹ Archives of Internal Medicine, February, 1919, p. 150.

meningeal manifestations, the person in the interval appearing to be in perfect health. The intervals may last for a few days or a few weeks. The other variety, which is the subject of Gordon's paper, is a prolongation of the infection in the meninges. As early as 1845, Tungal mentioned the presence of disturbances in the brain proper in the course of a prolonged case of cerebrospinal fever. Since that time there have been a number of cases reported in the journals under various titles, chronic hydrocephalus being the usual feature. Eight of Gordon's ten cases were autopsied. Diffuse pachymeningitis with irregularly distributed patches of thickened membrane were found, especially along the larger bloodvessels and mostly near the base of the brain and along the cerebellum. In some there were purulent areas. The ventricles were overfilled with fluid, and the communication between them evidently clogged; in all 8 cases there was a considerable quantity of turbid fluid and in 2 it was purulent. In addition to the changes seen in the meninges, the cortex was also affected, as was demonstrated by microscopic examination. The cerebrospinal fluid was somewhat yellow in 2 cases, but in the majority it was clear; other observers, however, have noted a change from turbid to clear in some cases, although this is not so in every case and there were some cases in which the fluid was purulent at first, then cleared, then became purulent again. In the early stages of the disease, albumin was found in large quantities, but later on, three or four months after the onset, the amount found was negligible. The polymorphonuclear cells are replaced by mononuclears so that after several weeks they are almost the only cell present. The meningococci are present in the beginning, but their number becomes smaller and smaller, and after several weeks are only met with occasionally.

The clinical picture is that of an ordinary meningitis, but in place of having the symptoms subside there is only a remission. There is rigidity of the neck and spine and some difficulty in walking, the patient's attention and memory are affected and the general intelligence lowered. The remission lasted in Gordon's cases from nine to twenty-one days, after which there was a sudden reappearance of the acute stage, with fever and the usual mental and physical symptoms. This disappears again and gradually subsides for a period of one or several weeks. This keeps up for varying lengths of time, when the motor, sensory, trophic and psychic spheres, and general nutrition changes are noted. The subcutaneous fat disappears and the bones appear to be covered with thin, wrinkled skin which is liable to be irritable. Where there is marked amyotrophy, the neck is more rigid than before, the limbs are in a state of contraction and the patient remains immobile although sometimes the contraction is not so marked and movements are possible. The reflexes are diminished and the movements remind one of those seen in cerebellar affections, being awkward or ataxic. There is pain in the neck, especially in the dorsolumbar region radiating down the extremities, and severe headache. There is a striking hyperesthesia and more or less changes in the hearing and impaired vision. The bladder and rectum sphincters become involved, although there may be remissions in this. There is an intellectual hebetude.

The course of the disease is variable. The longest case of Gordon's lasted thirteen months, and the briefest, two months and a half, most of the cases dying after a gradually increasing prostration. Eight of the cases were in adults, and 2 in children, seven and thirteen years of age, respectively. In the cases seen from the onset, the diagnosis will not be difficult, but, in those seen late, the condition may be mistaken for tuberculous meningitis, poliomyelitis, polyneuritis or polioencephalitis, or possibly brain tumor.

The use of large quantities of serum into ventricles and into the spinal canal would seem to be a rational therapy, although the conditions in which such extensive changes have taken place, the chances of this doing very much good are rather doubtful. Gordon was not permitted the use of the intravenous method of treatment in any of his cases.

THE TREATMENT OF MENINGITIS. It is a matter of great regret that observers working in different countries cannot get together and agree on something like the same nomenclature for bacteria; this is not impossible as has been shown by the work done by anatomists, and while the problem is somewhat different and even more difficult, it would seem that the almost hopeless confusion could be avoided. For example, in dealing with as important a subject as the treatment of meningitis, one is confronted by the fact, as Dopter has pointed out, that the term meningococcus is applied to a group of organisms, all very closely related but differentiated from each other by serologic reactions. He suggested the name parameningococcus and since then workers in different countries have grouped them in various ways. Thus in England, Gordon has Types I, II, III and IV. It depends on which strain is standard as to how the classification will run and the others in a certain amount, overlap it, but from a practical standpoint such a classification seems to be satisfactory. In France, Nicolle has four groups, Types A, B, C and D, and Flexner and others have contributed various classifications. Nicolle's Type A is supposed to be the original meningococcus and the others parameningococci. It is generally stated that this Type A corresponds to Gordon's Types I and III, and Type B to Gordon's¹⁶² Types II and IV, but this is not perfectly clear inasmuch as Flexner regards Gordon's Type I as corresponding to the parameningococcus.

The importance of a uniform classification is made clear when one considers that the successful use of the meningococcus serum depends very largely on giving the serum which corresponds to the infecting organism. In England, the disease is not very successfully combated by using the serum, probably on account of the very nature of it. There are two methods of practice: one is to ascertain the type to which the infecting organism belongs; the other is to inject serum made up of different strains. Thus, Dopter used quickly parts of Antitype A and Antitype B serum, which represent the two most prevalent types in his experience. This plan seems to work, on the whole, rather better than to give only one type of serum with the hope that it might be the right one.

In France, Bériel has suggested a sphenoidal puncture in cases which

¹⁶² *Lancet*, June 21, 1919, p. 1083.

show signs of hydrocephalus. These cases have ordinarily been treated in young infants by puncture through the anterior fontanel into the widest part of the ventricle. In older individuals the ventricular puncture has been carried out through a trephined opening. Dorsal puncture has also been suggested, but certainly would not seem to be the desirable thing for anything like general use. Other means of preventing cases which show a tendency to become chronic have been suggested, one of which is the use of vaccines in combination with the use of the serum intraspinally. Dopfer suggested a dose of from 250 million organisms, with a maximum of 25 billion, but this dosage could doubtless be exceeded with benefit.

Mumps. CEREBRAL COMPLICATIONS OF MUMPS. This subject has attracted a certain amount of attention and there has grown up a very considerable amount of literature which a few years ago was collected by Acker.¹⁶³ More recently, Haden¹⁶⁴ has made a study of this subject. Before the days of lumbar puncture the symptoms were commonly spoken of as meningismus, but the cerebrospinal fluid findings showed that there is actually a meningitis, and now Haden points out that there is much to make them believe that the condition is one of encephalitis, and, in some, one of involvement of the meninges. In most of the cases the symptoms are out of all proportion to the meningeal changes as shown by the changes in the spinal fluid. In this connection we may note the work of Latham,¹⁶⁵ who calls attention to the frequent association of orchitis in cases of cerebrospinal fever. In his cases the meningococcus was usually found in the blood and it may be possible that in the cases of mumps showing cerebral symptoms the examination of the blood may offer something of value.

LUMBAR PUNCTURE IN MUMPS. The cerebral complications of mumps have been commented on so frequently that one would not recur to this subject were it not for the fact that Haden¹⁶⁶ has pointed out that a very useful method of treating such cases is by the use of lumbar puncture. The headache is relieved, the temperature usually falls to normal quickly and the patients have all recovered. The fluid was clear in all except one case where there was slight turbidity. There are curious variations in the leukocyte counts. In 4 there was 100 per cent. small mononuclears. In the others there were variations in the picture in the cases as follows: Polymorphonuclears, 42 per cent., mononuclears, 58 per cent.; polymorphonuclears 71 per cent., mononuclears, 29 per cent.; polymorphonuclears, 37 per cent., mononuclears, 63 per cent. All of these were from one case. A second case showed 40 per cent. polymorphonuclears, mononuclears, 60 per cent. A third, large mononuclears, 4 per cent., small mononuclears, 96 per cent.; a fourth showed small mononuclears 82 per cent., large mononuclears, 18 per cent.; the fifth, large mononuclears, 52 per cent., small mononuclears, 48 per cent.

¹⁶³ American Journal of Diseases of Children, December, 1913, p. 399.

¹⁶⁴ Archives of Internal Medicine, June, 1919, p. 737.

¹⁶⁵ Journal of the American Medical Association, January 18, 1919, p. 175.

¹⁶⁶ Archives of Internal Medicine, June, 1919, p. 737.

Globulin was noted in three cases and cultures from all cases were negative, as was also the Wassermann when it was done.

Pneumonia. A NEW METHOD FOR TYPING PNEUMOCOCCI. All methods in use have distinct disadvantages. Taking advantage of an observation made by Rosenow, and later by Longcope, that pneumococci produce a coagulum when grown in the serum of patients suffering from pneumonia, Loewe, Hirshfeld and Wallach¹⁶⁷ have suggested a procedure based on this fact.

"Ten cubic centimeters of blood are drawn with sterile precautions into test-tubes containing a few crystals of potassium oxalate (sufficient to prevent clotting). The blood is then shaken with pure fresh ether, added in small, successive amounts, until the red cells are completely laked. The laked blood is transferred to a sterile centrifuge tube and centrifuged at high speed for five minutes. The disk of red cell shadows which collects at the surface is removed with a heated platinum loop. With a sterile pipet, 0.3 c.c. of the laked blood is placed in each of four sterile stoppered tubes 0.8 by 13 cm. To each of the first three is added 0.5 c.c. respectively, of saline emulsion of proved Type I, II and III pneumococci grown on glucose serum agar. The fourth tube constitutes the control. Sterile physiologic sodium chlorid solution is added to all tubes, sufficient to make up to 1 c.c. Sterile pipets are used throughout. All tubes are stoppered and placed in a water-bath at a temperature of 37° C. until the color change appears.

"The reaction consists in the formation of hemoglobin derivatives, mostly methemoglobin, which impart to the tube an unmistakable brownish-red color. The final result is a dark brownish-red, gelatinous clot. The reaction, as now determined by the naked eye, has been noted as early as after two hours. The average time for appearance of color change is from six to eight hours."

The blood should be tested as soon after withdrawal as possible and clotted blood should not be used. The observations were made on 52 patients, and in 49 of these the agglutinin reactions confirmed the blood test. With the Avery and precipitin tests the results were nearly the same, although not quite uniform. The advantages urged for this method is its simplicity, the fact that when the reaction occurs it is unmistakable and persists and that it can be made with from 5 to 10 c.c. of blood which is always obtainable, whereas satisfactory sputum cannot always be obtained. It is also possible to determine the presence of mixed infections by this method.

TYPE I PNEUMOCOCCUS AMONG PORTO RICAN LABORERS. At Camp Jackson, Columbia, S. C., 1653 Porto Rican laborers were used in construction work shortly after the appearance of an epidemic of acute respiratory disease. Park and Chickering¹⁶⁸ made a study of these individuals, which brings out one or two points worthy of note. Soon after their arrival, 1003 of them were admitted to the Base Hospital with a diagnosis of influenza. Of these, 220 exhibited signs of complicating pneumonia, and 67, or 30.4 per cent., of these died. Their

¹⁶⁷ Journal of the American Medical Association, July 19, 1919, p. 170.

¹⁶⁸ Ibid., p. 183.

experience showed that Porto Ricans under favorable conditions are susceptible to lung infection by the Type I pneumococcus, and that the disease pursues a typical course, accompanied by a bacteremia in about the same proportion as among white persons. In the Type I cases the use of the specific serum seemed to give good results and in this series the mortality was 6 per cent. The Porto Ricans seemed to suffer less from serum sickness than white individuals.

PROPHYLACTIC VACCINATION AGAINST PNEUMONIA. Cecil and Vaughan¹⁶⁹ have made a study of about 80 per cent. of an entire camp, using a pneumococcus lipovaccine. The doses employed in all cases was 1 c.c. containing approximately ten billion each of Types I, II, and III. In all, 13,460 men were inoculated at Camp Wheeler. The local and general reactions were mild, only 0.7 per cent. were sufficiently affected to need hospital care and none of these were seriously ill. Most of the troops were under observation for two or three months after vaccination, during which period there were 32 cases of *Pneumococcus* Type I, II and III pneumonia among the vaccinated of the camp, and 42 cases of pneumonia among the unvaccinated one-fifth of the camp. If, however, all cases of pneumonia that developed within one week after vaccination are excluded from the vaccinated group, there remain only 8 cases produced by fixed types and these were all secondary to severe attacks of influenza. This excluding is justified by the fact that protective bodies do not begin to appear in the serum until eight days after the injection of pneumococcus lipovaccine. Nothing occurred which would show that the vaccine predisposes the individual even temporarily toward either pneumococcus or streptococcus pneumonia. The incidence rate of pneumonia per 1000 men during the experiment was twice as high for unvaccinated troops and nearly seven times as high for unvaccinated seasoned men as for vaccinated seasoned men. It was noted, however, that influenza causes a marked reduction in resistance to pneumonia (all types) even among vaccinated men. The death-rate was higher in the unvaccinated, 22.3 per cent., than in the vaccinated, 12.2 per cent., and the death-rate for pneumonia among vaccinated troops was 11.9 per cent. as against 31.8 per cent. in the unvaccinated. The mortality rate in pneumonia secondary to influenza was apparently not much influenced by vaccination. Cecil and Vaughan are of the opinion that these results justify the further application of the prophylactic vaccine, both in civil and military life.

SERUM TREATMENT OF LOBAR PNEUMONIA. There have been a great many contributions to this subject and perhaps one cannot do better than to consider a summary by Park.¹⁷⁰ Of course, it must be borne in mind that the bacteriology of lobar pneumonia and bronchopneumonia is not the same. To be successful there must be a serum rich in antibodies for the specific type of pneumococcus existing in the lesions, and such a serum must be able to reach the organisms in time and in sufficient concentration to prevent them from harmful development. Up to the

¹⁶⁹ *Journal of Experimental Medicine*, 1919, xxix, 457.

¹⁷⁰ *Monthly Bulletin of the Department of Health of the City of New York*, April, 1919, p. 89.

epidemic of influenza, lobar pneumonia was generally due to some variety of pneumococcus, but since then there have been fewer clear-cut cases of lobar pneumonia and bronchopneumonia, and in even what are apparently typical cases of lobar pneumonia other organisms, influenza bacilli or streptococci, are found in abundance in addition to the pneumococci. In the United States, about 75 per cent. of all lobar pneumonia cases were caused by pneumococci of three types, which are known by the numbers I, II and III. The other 25 per cent. are caused by a multitude of strains, so numerous that in a moderate number of cases no repetition of the same type is apt to be met with. To prevent too numerous classifications all of these are grouped under the head of Type IV. In South Africa, Lister found a distinctly different type of pneumococcus which has not as yet been found in the United States. The Type II group may be subdivided into other groups.

It is very important to continue the study of the reactions of the various strains of the organisms isolated, as since the pandemic of last year there has been a complete change of the proportion of the different types. The serums for the various types may be briefly stated as follows: Type II produced only about 10 per cent. as much as Type I, and Type III still less. The amount of immune bodies produced is measured by injecting mice with a definite dose of pneumococci, together with a definite amount of serum. The differentiation of the type of organism is usually made by injecting fresh serum into the peritoneal cavity of a mouse and, after six to twelve hours, washing out the peritoneal cavity and testing the agglutinating characteristics of the greatly multiplied pneumococci. There are other tests, some using the blood. They require from eight to fourteen hours to do, and can only be done successfully by very experienced and skilful workers. Park recommends the following procedure: The size of the patient and the strength of the serum has not been considered in the size of the dose, although theoretically they should be. He believes that the serum should be standardized so that 0.2 c.c. of a recent serum should protect against 100,000 fatal doses of a very virulent Type I strain of pneumococcus, and he does not believe that a serum should be put out or used that contains less than half of this strength.

Large intravenous injections have been found to give the best results, but dilution with an equal amount of sterile salt solution is advisable, although not absolutely necessary. One hundred cubic centimeters is regarded as an average dose for an adult and is to be repeated every twelve hours, or if precipitable specific substance is present in the urine, preferably every six to eight hours until an effect is obtained. From 200 to 500 c.c. of serum is generally used. If there is a beginning rise of temperature after a fall subsequent to an administration of serum, it should be repeated. One of the great dangers of the use of the serum is the production of the serum sickness. There are several ways of preventing this, one being to precede the injection by an hour or two with an intracutaneous injection of the serum. If the patient is sensitive, a local edema and erythema develops. Another suggestion is to give 0.5 to 1 c.c. of serum subcutaneously several hours before the larger

intravenous injection. Both of these methods mean a loss of time and, if indications are very urgent for its use, it is suggested that a few cubic centimeters of serum be injected into the vein very slowly and then the flow interrupted for several minutes and then an additional few cubic centimeters allowed to flow in, using at least fifteen minutes to give the first 15 c.c. If no reaction is encountered, the rest of the serum may be given without fear. The serum must be at body temperature or it is apt to produce chills.

There is a second form of serum reaction consisting of chilliness or a distinct chill followed by an abrupt rise or fall of temperature and may come on during or after an injection. There may also be cyanosis and some difficulty in breathing. There is no way of adequately guarding against this. There is also a later form of serum sickness coming on some days or even after a week or two, and this is characterized by an urticaria, sometimes by edema of the skin, joint pains, and swelling of the lymph nodes and a rise of temperature.

Following a large intravenous injection there is, in about 30 per cent. of the cases, an immediate, more or less severe chill and a rise of temperature which lasts for a short time. This is more apt to occur after the first injection, but sometimes may follow the later ones.

If pneumococci were found in the blood, they usually disappeared within twelve hours. The temperature usually falls rapidly after the initial rise to a point lower than four of the rise and, as a rule, the improvement is sooner than the average untreated case. Serum sickness, consisting of rashes and painful joints, etc., occurs to a greater or less extent in about 50 per cent. of the cases in convalescence. This may be annoying, but is not dangerous.

Poliomyelitis. THE PERSISTENCE OF THE VIRUS OF POLIOMYELITIS IN THE NASOPHARYNX. The Rockefeller school of investigators have been foremost in bringing forward the evidence tending to show that poliomyelitis is transmitted by the virus being carried into the nasopharynx. The virus has been detected in secretions in this part of the body by inoculation tests in three sets of conditions. First, in the disease itself; secondly, a considerable period after the acute attack of the disease has abated; and third, in healthy persons who have been in contact with cases of poliomyelitis. At the present time the demonstration of the virus depends upon the inoculation test, and, unfortunately, requires a highly trained personnel and very considerable expense for animals. It is generally conceded that the virus of the disease is communicated by personal contact. It is also conceded that the virus is found in the nasopharynx. The fact that the virus has been found in healthy persons who have been in contact with early cases of the disease, even though this has not been done many times, and also that the virus has been recovered in individuals who have had the disease, has led to the opinion urged chiefly by Kling and Pettersson and Wernstedt, that like some diseases of bacterial origin, notably epidemic meningitis, healthy and chronic carriers of the virus are frequent. The epidemiology of poliomyelitis is still to be worked out, but Flexner and Amoss¹⁷¹ believe that

¹⁷¹ Journal of Experimental Medicine, 1919, xxix, 379.

this view is probably not correct. In man the virus has been detected by the inoculation test in washings from acute cases, rarely in similar washings from healthy contact, in the nasopharyngeal tissues obtained from fatal cases in the first week of infection, but rarely, if ever, from nasopharyngeal tissues removed surgically at later periods in the course of the disease. In monkeys the virus has been detected in the secretions in the tissues removed from early cases, and rarely from cases several weeks or months after recovery.

From a series of careful observations, which need not be given in detail, Flexner and Amoss have shown that the virus is regularly present in the nasopharynx in cases of poliomyelitis in the first days of illness and especially in the fatal cases, and that it diminishes relatively quickly as the disease progresses except in rare instances; and that it is unusual for a carrier state to be developed. They conclude that the period of greatest infectivity of patients would appear to be early in the disease, which is apparently the time when the communication of the virus from person to person takes place. They believe that while the available evidence does prove that healthy carriers of the virus do occur, they do not believe that the data indicates the frequency with which carriage arises, and they point to the fact that even after a severe and widespread epidemic, such as occurred in the United States in 1916, the disease may virtually disappear in two or three years, and this would seem to show that the enduring carriers of the active virus, whether healthy or chronic, are of exceptional occurrence.

BLOOD COUNTS IN EXPERIMENTAL POLIOMYELITIS IN MONKEYS. As yet there has been no consensus of opinion on the blood changes in poliomyelitis, although all authorities are agreed that abnormal white blood counts are constantly observed. In 1910, Müller described a distinct leukopenia with a relative leukocytosis as characteristic of the febrile stage. La Fétra, on the other hand, had previously reported a moderate leukocytosis. Gay and Lucas in the same year stated that there was the occurrence of an acute leukopenia during the acute stage and that the differential count showed a relative increase in both eosinophiles and lymphocytes. Peabody, Draper and Dochez reported, from an extensive study in human cases, a constant marked leukocytosis with a constant increase in polymorphonuclear cells of 10 to 15 per cent. and a diminution of lymphocytes of 15 to 20 per cent.

Taylor¹⁷² made a series of studies upon monkeys suffering with experimental poliomyelitis. This disease is comparable to the severe forms in man, and it was thought that the studies upon these animals would give a more nearly uniform result than studies made on human cases in which there are so many factors which might contribute to variation. All of the blood counts made during the course of typical acute experimental poliomyelitis showed a variation from the normal. After the injection of active poliomyelitis virus the lymphocytes were diminished, but returned to their normal number and are actually increased between the fourth and sixth days of the incubation period. The polymorphonuclear count is high at this time. During the first three days after the

¹⁷² Journal of Experimental Medicine, 1919, xxix, 97.

onset a marked diminution in the lymphocytes takes place. At this time the polymorphonuclear cells are materially increased. When the monkeys become completely prostrated there is a further decrease in the actual number of lymphocytes, which remains low for long periods. Finally, the total number of polymorphonuclear cells returns to normal, but there remains a relative increase. During recovery, both types of cells return to the average normal count and relation. In the monkeys receiving virus that did not develop symptoms, there seemed to be a tendency for the lymphocytes to decrease following the administration of the virus. This decrease was followed by a gradual return to normal. There is no evidence of lymphocytic stimulation after recovery. The eosinophiles, basophiles, large mononuclears and transitionals follow the changes observed in the neutrophils. These results are consistent with the observations of Peabody, Draper and Dochez on human cases.

One of the monkeys was used by Smillie and attempts were made to produce poliomyelitis with a cultivated virus; typical pathological lesions were not observed at autopsy, however, the symptoms and the blood curve simulating those observed in known poliomyelitic monkeys are suggestive, and offer possible additional proof that the monkey developed mild poliomyelitis after intracerebral inoculation with the fourth generation of a culture of the globoid bodies and recovered before it was etherized for autopsy.

THE EFFECTS OF LARGE DOSES OF X-RAYS ON THE SUSCEPTIBILITY OF MONKEYS TO EXPERIMENTAL POLIOMYELITIS. Amoss, Taylor and Witherbee¹⁷³ have made a study of this subject which may help to elucidate some of the problems of immunity and infection. We know comparatively little about poliomyelitis and it seems that out of the large number of people who are probably exposed to the disease, but few contract it, or, if they do, do not get it in such a form as to have the nervous system involved. This is quite in contrast with some of the other diseases, such as measles, in which the susceptibility is very general and the disease shows practically no selective action. While poliomyelitis should attack some and not others is not at all clear, but it has been shown by Flexner and Amoss that in monkeys infection by means of the blood stream is not possible except with massive doses, but smaller doses may cause the disease after intraspinal injection of substances setting up an aseptic meningitis. Infection by the nasal route is also rendered much easier by this procedure. This led to the suggestion that the difference in susceptibility may lie in the patency or continuity, as the case may be, of the meningeal choroid plexus. A second point is that Zingher has shown that in apparently normal children only 30 per cent. give a positive reaction to intradermal injections of diphtheria toxin, whereas those recently recovered from poliomyelitis give about 80 per cent. of positive reactions. This suggests either a general state of lowered resistance, as indicated by susceptibility to both poliomyelitis and diphtheria, or, less probable, that infection with the former reduces resistance to the latter. A third point is that Amoss and Taylor have shown the power of nasal washings from certain

¹⁷³ Journal of Experimental Medicine, 1919, xxix, 115.

individuals to neutralize the poliomyelitic virus, and this may indicate the first line of defense against poliomyelitic infection.

The use of the x-ray was found to diminish both the number of circulating lymphocytes and the resistance of monkeys to weak poliomyelitic virus, but whether the lowered resistance caused by the x-ray was due to reduction of lymphocytes in human cases and in monkeys during the acute stage of the disease, or to some other factor, is not known. The gradual return of the cells to their former number during recovery strongly suggests a definite relation between these cells and one factor of resistance in poliomyelitis. The lessening of resistance by the x-ray, while definite, was not sufficiently great to warrant the conclusion that the major factors governing infection or non-infection were being dealt with. An attempt was made to reduce the immunity in the monkey acquired by an attack of experimental poliomyelitis, but while the x-rays reduce the circulating lymphocytes to one-fifteenth of their original number, it failed to destroy the immunity.

A BEDSIDE TEST FOR GLOBULIN. Amoss¹⁷⁴ has suggested the use of a reagent prepared by dissolving 3 grams of anhydrous potassium dihydrogen phosphate in 100 c.c. of distilled water and adding 0.05 c.c. of glacial acetic acid. In making the test, 0.3 c.c. of the spinal fluid plus 0.6 c.c. of the reagent are mixed in a small agglutination tube and placed in boiling water for six minutes. The globulin is precipitated if there is any present. This test is particularly suited for field work and while it is slightly less delicate than the Noguchi test, it can evidently be depended upon.

SECOND ATTACKS OF POLIOMYELITIS. Usually the immunity produced by an attack of poliomyelitis is complete and lasting, but second attacks are not entirely unknown. These second attacks should be carefully differentiated from relapses or recurrences at a short interval after the original attack. These are not so uncommon and are only a manifestation of the original infection. In 1910, Eshner¹⁷⁵ made a study of this subject and reported a case in which eleven years elapsed between the two attacks. The first case was undoubted poliomyelitis. The second might possibly have been a traumatic disturbance, as the patient had had a severe fall prior to the onset.

Francis and Moncreiff¹⁷⁶ have reported an instance of a second attack in which the patient, when three years of age, had a typical poliomyelitis, with fever, paralysis of the arms and transient weakness of the legs. Almost complete recovery occurred several months later, but there remained in the right arm a well-marked residual paralysis of the deltoid, forearm supinators and all the intrinsic muscles of the hand. When the girl was eighteen she complained of general malaise, weakness, especially of the legs, and inability to stand or walk. Ten days previously there had been some malaise and pain in the lumbar regions and legs which came on following exercise. At this time there was a catarrhal affection of the nose and throat with slight fever which continued for four or five

¹⁷⁴ *Journal of the American Medical Association*, May 3, 1919, p. 1289.

¹⁷⁵ *Medical Record*, September 24, 1910, p. 526.

¹⁷⁶ *Journal of Nervous and Mental Disease*, April, 1919, p. 273.

days. The loss of power occurred on the eighth day. The left leg was completely paralyzed, the right partly so. Four weeks after admission to the hospital the function of the muscles involved was but slightly improved, but six months later there had been a very considerable improvement and the patient was able to move about.

Acute Infective Polyneuritis. A New Disease. A curious disease and one that is rather rare has been observed in the troops in France and Flanders and shows a remarkably constant clinical picture of generalized palsy. A report of great value is made by Bradford, Bashford and Wilson.¹⁷⁷ The features of the malady are uniform and there is little difficulty in recognizing it, but it is liable to be overlooked by those unfamiliar with it and it is probable that in its atypical form it may exist in larger numbers than is ordinarily believed. Similar, if not identical, findings have been described by Osler in his *Principles and Practice of Medicine*, under the term of acute febrile polyneuritis, and Gordon Holmes¹⁷⁸ has described cases and discussed the differential diagnosis and its separation from other forms of neuritis, such as poliomyelitis and Landry's paralysis.

Bradford reports on the clinical phenomena of the disease in man from a series of carefully selected typical cases. In the beginning of the war he had noted isolated instances. His study is the result of observation of 30 cases. The onset in a small proportion of cases was sudden, with the development of the paralysis, but in the majority of the cases there was a distinct history of illness with general symptoms before there was any loss of power. The initial illness when it is present is usually, though not always, mild. In some cases it may be sufficiently severe to suggest the possible existence of cerebrospinal meningitis. The most constant initial symptoms are moderate fever, headache, vomiting and pain in the back. There were sometimes joint pains and occasionally there may be a sore-throat. No rash has ever been observed. The fever is of short duration, lasting two to four days, the symptoms subside rapidly and the patient regains his former health, and in the army many of these were regarded as pyrexia of uncertain origin. This period of illness is followed by a period of latency of some variation. Sometimes this latter period is very short, only two days, more often from two to four weeks and possibly even five or six. In the less severe forms the onset of the paralysis is noted as a general weakness which increases more or less rapidly and it is not obviously more marked in one region of the body than another, but in the majority of cases, and especially in the more severe ones, the onset of the palsy is more characteristic. The common mode of onset is for the patient to lose power suddenly in the legs, so that he falls down on parade and even on the march. Sometimes he is unable to rise from a sitting posture, although a short time previously he felt perfectly well. Numbness in the extremities may precede or accompany the onset of the palsy. There is usually no fever, but occasionally slight pyrexia may be present. In most

¹⁷⁷ *Quarterly Journal of Medicine*, October, 1918, Nos. 45 and 46, vol. xii, and January, 1919, p. 88.

¹⁷⁸ *British Medical Journal*, July, 1917, p. 37.

cases the motor weakness is first developed in the legs and at first is limited to them. In some of these cases when examination was carefully made, the arms were also found to be involved, but in many there may be a distinct interval before this is the case as two or three days may elapse. One of the most characteristic features is the marked degree in which the paralysis involves the proximal segments of the extremities. Thus the shoulder and hip movements may be made with great difficulty while the patient may still move the fingers or toes freely. The paralysis is never limited to a group of muscles, although it may be more severe in one group than in another, as just noted. Another remarkable feature is the great frequency with which the muscles of the trunk are involved, as the patients are not only not able to raise themselves or sit up in bed, but in many cases are even unable to turn in bed, and often cannot even raise their heads from the pillow. Involvement of the muscles of respiration renders the case very grave and, as intercostals and diaphragm may both be affected, death may result from pulmonary complications.

In the milder cases the condition may be overlooked or passed as a functional or neurasthenic thing, or the patient may even be suspected of malingering. The face is involved in a curious way; usually a general weakness of the muscles and not a complete paralysis and owing to the fact that it is bilateral may not produce any marked change in the expression and so escape notice. In some instances it may be more marked on one side than on the other. The palsy is of the infranuclear type and involves both the upper and lower parts of the face. The oculomotor nerves are mildly affected, and the larynx and tongue only occasionally. It should be noted that the palsy is almost always progressive in character and may conform to the muscle type. It may also be noted that muscular wasting is not a feature of the disease and in most cases is absent. The sensation is constantly affected. There may be numbness or tingling, and anesthesia and analgesia may be present, especially in the distal segments of the limbs. The tendon reflexes are lost wherever there is a marked motor palsy, but, if examined at the onset, the knee-jerk may still be present. The superficial reflexes vary. The plantar is usually lost, while the abdominal and cremasteric may be retained. The sphincters are, as a rule, not affected. The functions of the brain are usually not disturbed. There may be occasionally some little drowsiness, but there is always full consciousness even in the fatal cases. In a small proportion of cases there was some tachycardia. There was a moderate leukocytosis present in the early period of the paralytic stage, the counts varying between 12,500 and 19,000, and the differential counts showed no very striking departure from the normal. The cerebrospinal fluid was examined in 4 cases and showed no abnormality. The course of the disease is usually slow, but sometimes may be extremely rapid, death taking place within a short time.

The mortality is rather high; in the 30 cases, death occurred in 8; 2 on the fifth day, 1 on the sixth, 1 on the eighth, 1 on the eleventh and 1 on the twentieth. Over one-half of the deaths occurred within a week and only one after the eleventh day. Death was generally due to pul-

monary complications consequent upon respiratory paralysis. In the cases in which recovery ultimately took place, the palsy, after being progressive, became stationary and then began to improve. This improvement was noticed first in the face, then there was a gradual return of power in the trunk and limbs. The paralysis and weakness may last for months.

Autopsies were made in 7 out of the 8 fatal cases and there were no gross lesions in the nervous system, although in some the brain seemed somewhat edematous and there was some congestion of the vessels. Lung lesions were noted in some cases.

The youngest age at which the disease has been seen is nineteen years and the oldest forty-nine, and nearly one-half of the cases occurred in men under twenty-five years of age. It should also be noted that diphtheria bacilli were never found in any examinations of the throat. The clinical picture presented, while in some respects resembling the ordinary forms of neuritis, showed certain distinct differences. The remarkably constant bilateral affection of the face, the involvement of the muscles of the trunk and the presence of generalized weakness rather than actual paralysis of muscles or groups were all characteristic. Involvement of the proximal segments of the limbs to a greater degree than the distal ends, and the progressive nature are also striking features. The authors believe that they are dealing with a distinct clinical entity and that it is a diffuse affection of the nervous system affecting the spinal cord, spinal ganglia, and peripheral nerves and with but slight incidence on the cortex. The lesion is essentially one affecting the nerve elements, cells, and fibers. They have succeeded in transmitting the disease from man to monkey, and the characteristic lesions were reproduced in the animal used for observation. A living virus can be demonstrated both in the living cases and in the inoculated monkeys, and the virus can be recovered from the experimental animal.

If the cases of this so-called polyneuritis are really abnormal or rare forms of poliomyelitis, one would expect to find a large number of the ordinary forms of the disease, whereas, as a matter of fact, poliomyelitis was a rare disease among the troops. Poliomyelitis is characterized by a sudden affection of one or more muscle groups and other features which are not present in polyneuritis.

The second part of the paper by Bashford deals with the morbid anatomy, both in man and in the monkey. He also conducted the observations on animals. He succeeded in transmitting it by the use of emulsions preserved twenty-five days to seven months in glycerin, and also by direct inoculation with fresh cord, and also by inoculation of the pure culture prepared by Wilson. Pathologically, the disease resembles poliomyelitis, although Bashford believes that it can be distinguished from it. He gives a minute account of the histological examinations, both in man and in monkeys. There is clearly a general involvement of the gray matter and the nervous system with a gradually ascending progression. The nerve cells of the cord are involved early and later there is an accumulation of round cells about the damaged or degenerated cells. There is involvement of the posterior root ganglia and hemorrhages throughout the cord.

The third of the contributions on the isolation and culture of the virus is by Wilson. Using the Flexner and Noguchi technic, he found that after the fourth or fifth day there was a fine, granular haze to be observed in the serum agar in the vicinity of the nervous tissue. The haze gradually deepens and at the same time extends throughout the serum agar. About the seventh day minute translucent colonies may be seen on the surface of the agar, and from this stage the growth is rapid. The surface colonies increase in size, assume a faint yellow color and their upper limits become irregular. By the twelfth to fourteenth day the colonies have united to form a yellowish brown continuous layer, showing slight elevations on its surface, while the serum agar has become definitely opaque. Incubation must be carried out at 37° C. as no growth occurs at room temperature. It withstands a temperature of 45° C. for fifteen minutes, but exposure to 60° C. for a similar period kills the organism.

In suitably stained cultures from five to ten days old, it appears as a minute, rounded, oval or kidney-shaped body, measuring 0.2 to 0.5 mikrons in diameter, presents a darkly stained, rounded spot, eccentrically placed, which is surrounded by a narrow faintly stained area. The staining is accomplished with difficulty and it is necessary to use a mordant, such as tannic or carbolic acid, after which staining with Loeffler's or polychrome blue will produce satisfactory results.

This organism has been isolated from the nervous tissue in two fatal cases of polyneuritis and also from four monkeys inoculated with emulsions of the spinal cord from three such cases. The organism inoculated subdurally into a monkey has produced the disease clinically and pathologically, and, finally, the organism has been recovered at postmortem from the nervous system of the animals so inoculated. Inasmuch as it fills all the requirements of Koch's law, it may be regarded as the etiological factor of the disease.

With regard to its relation to the globoid bodies of poliomyelitis, it is evident that while the two organisms are closely related, although members of the same group, they are nevertheless distinct. They are alike in that they both show certain limitation as regards choice of medium and temperature of incubation. They require the presence of animal tissue in the culture, and the temperature must be that of the body. They are both strictly anaërobic. The course of growth under such conditions appears to be identical. The only difference determined and agreed upon by all authorities, however, is that the globoid bodies become more and more saprophytic in subcultures, while the reverse is true in the cultivation of the polyneuritis organism. It becomes increasingly difficult to grow in subcultures and ordinarily dies out in the fifth generation.

Taken all in all, this is a very illuminating piece of work, which will help throw light upon the problem of these curious infections involving the central nervous system. Much remains to be done with regard to all of them, but each contribution, especially when it is carefully carried out as the one in question, will finally lead to a solution of the problem.

The Spirochete of Rat-Bite Fever. In 1915, Futaki, Takaki, Taniguchi, and Osumi discovered a spirochete in the swollen lymph nodes of a rat-

bite fever patient. These Japanese observers, and Row, in India, working separately, subsequently demonstrated the existence of this organism, and later Futaki and his associates proved beyond doubt that this organism is the causative agent of the rat-bite disease occurring in Japan.

There has been a considerable number of publications containing more or less contradictory statements regarding it, so that Kusama, Kobayaski and Kasai¹⁷⁹ made a study of four strains, two from human beings, one from the white rat and one from the field mole. They found these spirochetes in the early stage of the infection, detected principally in the blood, but after two weeks a large number appear in the connective tissue, and as time goes on these are gradually increased. In laboratory animals, these spirochetes are always distributed in the subcutaneous and submucous tissues, in the eyelids, the lips, bridge of the nose, tongue, and also abundantly in the heart wall, in the adventitia of the aorta and large arteries within the visceral organs, and at times in the endocardium. It may also be demonstrated in the spleen, kidney and liver. Ordinarily it is not excreted through the saliva, or the normal mucous membrane, but is supposed to pass from the infected animal through abrasions in the mouth, such as frequently occur in the wild rat. By keeping infected and healthy animals in the same cage there were no positive cases among eleven guinea-pigs and only two positive cases among twenty-nine mice. The observers quoted believe that their observations show that the various strains all represent the same species, and they believe that in all probability the organisms described by Futaki, Carter, Breinl, Wenyon and others, are identical. They accompany the article with a table showing the characteristics of the various organisms.

Rocky Mountain Spotted Fever in the Domestic Rabbit. Rocky Mountain spotted fever has come in for a very considerable amount of work in the past years, but in the last few years very little has been done. One of the most important contributions, however, is that of Foot.¹⁸⁰ He has demonstrated that the domestic rabbit is susceptible to the disease, either by the infected tick (*Dermacentor venustus*) or by intraperitoneal injections of infectious blood from guinea-pigs or rabbits. In 1909, Gomez¹⁸¹ published a brief note on some observations he had made on the domestic rabbit. Since that time nothing has been done on this subject. It is an important field of inquiry due to the fact that the wild rabbit and hare may be carriers of the disease. Gomez was associated with Ricketts, but the latter did not believe that the rabbit was susceptible because he was unable to infect them by inoculating them with the virus from human cases, it being necessary first to reënforce the virulence by passage through a considerable number of guinea-pigs. Stiles also failed to infect them by using human blood, although Wilson and Chowning claimed to have discovered a *Piroplasma* in the blood of rabbits that had been inoculated with virulent human

¹⁷⁹ Journal of Infectious Diseases, April, 1919, p. 366.

¹⁸⁰ Journal of Medical Research, March, 1919, p. 495.

¹⁸¹ Journal of Infectious Diseases, vol. vi, p. 383.

blood. In 1912, Rucker reported that the disease was transmissible to the rabbit in a mild form.

Foot's observations need not be gone into in detail, but he has shown that not only can the rabbit be infected, but that the susceptibility of it to the disease is less marked and more variable than in the case of the guinea-pig, although the lesions produced are essentially the same as those found in guinea-pigs, monkeys or man. The immunity is not transmitted from parents to offspring in the rabbit. Wolbach has described a minute organism in the lesions in the various organs, and Gomez was able to demonstrate the same small diplococcoid organism in the intima of the vessels in the testes and in the skin.

This whole subject is one of extreme importance and should be thoroughly worked out, as if the rabbit is a factor in keeping up the disease it is very important that this be taken into account and an effort made to prevent the infection and to limit its spread.

Potassium Iodid in Experimental Sporotrichosis. Sporotrichosis is a disease which is attracting more and more attention, and a relatively large number of human cases have been reported. Practically all of these have responded promptly to treatment, and usually thirty to forty grains of potassium iodide per day will produce a complete cure in a few weeks. It should, of course, be continued for some time to prevent the recurrence which is otherwise apt to follow. Beurmann and Gougerot, in their monograph, *Les Sporotrichoses*, which was published in Paris in 1912, and Carongeau have shown that horses and mules, which are naturally susceptible to this disease, show prompt effect to the administration of the iodide. Curiously enough, the iodine and potassium iodide are relatively inert as concerns their direct germicidal power on the organism.

Davis¹⁸² has found that in 10 per cent. solution the organisms will live at least forty-eight hours, and in 1 per cent. solution the organisms were alive at the end of seventy-four days. They will also live in distilled water. The observations were made with a *Sporotrichum schenkii*. In order to study the subject further he produced experimental sporotrichosis in rats, and in these animals a cure was promptly effected by the use of potassium iodide, but the drug given to animals for eight days previous to the inoculation had no effect in preventing the infection. When given simultaneously and for a week following the inoculation, the infection appeared to continue without any interruption, but when the drug is continued longer, the lesions heal, becoming hard and contracted, although the sporotricha remain alive in their centers for a long time. The lesions in the peritoneal cavity become hard, firm, and small, and are surrounded by a dense fibrous capsule which evidently prevents their dissemination. It would seem clear, therefore, that the potassium iodide stimulates the healing process without inhibiting the growth of the organism. The French observers named above have pointed out practically the same thing in connection with their studies of the *Sporotrichum beurmanni*. Just what the mechanism in the body is with relation to iodine is not clear. Lortat-Jacob, in a Paris thesis,

¹⁸² Journal of Infectious Diseases, August, 1919, p. 124.

in 1903, expressed the view that the leukocytes are the active agents in the absorption of iodides or iodine after subcutaneous or peritoneal injection, and he believes that the drug causes a congestion and hyperactivity of the lymphoid tissue and that repeated small doses may lead to sclerosis of the tissues. For this and other reasons, the French have used iodine in tuberculosis of the glandular type.

Jobling and Peterson¹⁸³ have suggested that it is possible that the iodine saturates the unsaturated fatty acid soaps which act as anti-ferments and thus allows the fatty enzymes to digest the cells and tissues and to remove caseous matter. Davis is of the opinion that sporotrichosis, which is so easily transmitted to animals, furnishes a good object for the study of the behavior and action of iodine and iodides in chronic infections.

Immunization Against Scarlet Fever. In *PROGRESSIVE MEDICINE* for March, 1917, I reviewed certain researches that were made on scales from persons who had had scarlet fever and who were desquamating. In 1914, Caronia stated that he was of the opinion that these scales contained a specific antigen. Using the extract made from them, guinea-pig complement, and the serum from the scarlet fever patient, he was able to get a complement reaction.

Di Cristina, with a comparative vaccine, using 10 grams of desquamated scales of skin, 15 c.c. of convalescent serum, 0.8 per cent. of phenol and 1 c.c. of the guinea-pig complement, made some further studies. This was incubated for fifteen hours at a temperature of 37° C. The serum was drawn off and centrifugalized. One cubic centimeter of this was injected subcutaneously every second day, and after the second or third injection the complement of deviation could be obtained.

Recently the same author,¹⁸⁴ in connection with Pastore, has brought forth some new evidence. They found that horses treated with the vaccine developed antibodies in their serum. Forty children immunized by the method just outlined were left in the same room, sleeping in the same bed with scarlet fever patients and not one contracted the disease. Twenty-five children in families where there was a case of the disease did not show a single case in any of the children immunized. The vaccine does not produce any effects except an occasional transient eruption. It would seem that this work should be confirmed by others, as some method of coping with scarlet fever is a consummation devoutly to be wished.

Sprue in the United States. There has been for a long while some doubt as to the existence of tropical sprue in the United States; fortunately, this has now been cleared up, and Wood¹⁸⁵ has contributed another article which is of great value in calling attention to this condition which might easily escape diagnosis. In a previous article, he¹⁸⁶ attempted to collect all the references in the literature to the disease in America. The

¹⁸³ *Journal of Experimental Medicine*, 1914, xix, 383.

¹⁸⁴ *Pediatrics*, Naples, January, 1919, p. 1; *Journal of the American Medical Association*, March 1, 1919, p. 687.

¹⁸⁵ *Journal of the American Medical Association*, July 19, 1919, p. 165.

¹⁸⁶ *American Journal of the Medical Sciences*, November, 1915, p. 692, and *Transactions of the Association of American Physicians*, 1915, xxx, 505.

majority of cases occurred in southern States, but it is important to note that one case has been observed in New Hampshire, a Porto Rican case was seen in Syracuse, and there has been a case reported in Baltimore.

There are three groups of symptoms: Those of the mouth, the intestinal tract and of the blood. The tongue is inflamed, the fungiform papillæ congested, and there are eroded patches and superficial cracks on the dorsum and edges and, not infrequently, molar ulcers. The tongue in sprue is very much paler than in pellagra and there is an approach to the cobblestone appearance which is not seen in the latter disease.

Wood believes that after some experience the differentiation of these two diseases may be made by examination of the tongue alone. The intestinal symptoms are chiefly a diarrhea, affecting the patient chiefly from midnight to about the middle of the morning, after which there is usually, although not always, a cessation. The bowel movements are very large, suggesting a pancreatic condition with very marked acid reaction and a great deal of gas is mixed with them. There is a large amount of fat and the stools give a positive reaction for hydrobilirubin. There are other evidences of pancreatic insufficiency which may be demonstrated by the thymus nucleus test or the Sahli glutoid salol capsule test.

The blood picture is being given considerable attention at the present time. In many cases the color index is above one. While the changes in the blood are generally regarded as secondary, it is possible to confuse the picture with that of pernicious anemia. Wood is of the opinion that many cases of sprue are mistaken for pernicious anemia, but that the reverse is also true. There is a marked variation in the size of the red cells, and poikilocytosis. Stipple cells are very rarely found.

In a discussion of the paper, Alvarez, of San Francisco, stated that many people returning from the Orient and India were found to be suffering with the disease and recommends the use of a meat diet in the cure. The starches are almost immediately converted into gas. He believes that he can differentiate sprue from other types of diarrhea by feeding the patients strawberries. The individual with sprue will improve, curiously enough, whereas the other forms are made worse. The possibility of sprue in a pellagra patient must also be borne in mind.

Ectoenzymes in Streptococci. Bearing in mind some of the points brought out by Wright in his article under the heading of Lessons of the War, the demonstration of Tongs¹⁸⁷ of ectoenzymes in connection with streptococci is of very considerable interest. The enzymes excreted by various organisms have previously been studied by the method designed by Beijerinck, by Bijkman, and Buxton. It is highly probable that the action of the streptococci depend in some way upon the enzymes so produced. In the hemolytic streptococci there were three groups demonstrated, one digesting starch, one casein, and the other neither casein or starch. Among the green-producing streptococci there were two groups indicated, one digesting casein and one without action on starch or casein.

This observation, and others of a similar nature, will mean a great

¹⁸⁷ Journal of the American Medical Association, October 25, 1919, p. 1277.

advance in our understanding of the action of bacteria and will undoubtedly be the means of clearing up certain phases of increase and loss of resistance.

Epidemic Streptococcic Sore-throat. Keegan¹⁸⁸ has reported an epidemic due to a hemolytic streptococcus which occurred in a hospital at Chelsea, Massachusetts, and which resembled in every way the findings of epidemic streptococcic sore-throat reported in Boston, Chicago and Baltimore in 1911 and 1912. Numerous instances of postoperative rise in temperature in surgical cases associated with sore-throat and subsequent infection of the primarily clean surgical wounds with a peculiar hemolytic streptococcus was the first thing that called attention to the disease. The symptoms at the onset were sudden chilliness, dizziness, fever, headache, backache, general aching and prostration with an occasional initial leukopenia. The secondary symptoms were localized in the tonsils or lateral pharyngeal walls and the lymph nodes; the nasal sinuses, middle ear and mastoid came in for their share of complications, and in addition there were metastatic infections of the joints and surgical wounds. At this stage of the disease there was a moderate leukocytosis. There were no cases of bronchitis or bronchopneumonia. There was practically no possibility of spread by contamination, and it was thought that the epidemic originated in the nose and throat surgical wards, from which it spread by contact. The epidemic was controlled by suspension of operations for three weeks, the isolation of all acute throat cases and the elimination of all carriers of hemolytic streptococci from surgical cases.

An Epidemic Caused by the Streptococcus Hemolyticus. There is a practice common in many operating rooms of cutting strips of adhesive plaster and sticking them on the wall. These are used in the final dressing of a patient. Medalia¹⁸⁹ reports a very interesting thing in connection with this practice. In the hospital in question there were a number of undiagnosed pyrexias which ran a course of a few days, then dropped to normal and stayed so. The only clinical feature was slight irritation of the throat. Most of the patients were operative cases and a culture taken from the wall of the operating room contained the *Streptococcus hemolyticus*. The walls were washed and repainted and the practice of sticking adhesive strips to them was stopped and the epidemic ceased immediately.

Tetanus Without Trismus. It is very important to note certain differences in diseases caused by the use of protective inoculations. Before the days of antitetanus serum it was thought uniformly that trismus was one of the characteristic early signs of the disease, and in many instances the diagnosis would rest upon its presence or absence. With the use of antitoxin, the disease may be so modified that the muscular spasms may be confined to the groups immediately about the wound, and trismus and generalized convulsions may be wanting. This condition has previously been described in laboratory animals.

A leading article in the *Lancet* (January 18, 1919, p. 117) calls atten-

¹⁸⁸ Journal of the American Medical Association, May 17, 1919, p. 1434.

¹⁸⁹ Boston Medical and Surgical Journal, June 5, 1919, p. 635.

tion to the fact that Meyer and Ransom have brought forth the opinion that the increased irritability of the nerve centers is due to the passage of the toxin up the motor nerves to the spinal cord, and if tetanus cases were carefully watched at the onset, they believe that spasms of muscles in the neighborhood of the wound will always be observed as the earliest symptoms. Roubier, in the *Lyons Médicale*, has recorded a case of general tetanus so modified by serum that trismus was absent, and the absence of trismus in cases where local tetanus existed have been reported in quite large numbers. I have recently seen an instance of severe general tetanus in which the diagnosis was questioned because trismus, while present, was of a slight degree and not at all marked until the patient was practically rigid in all the other muscles, when the locking of the jaws became very apparent.

Trench Fever in the American Expeditionary Forces. Last year I commented at considerable length on the observations which had been made on this disease. Swift¹⁹⁰ has made a short report on this disease as it affected the American troops. It has been described in all the armies on the western front and from the vast number of reports it is impossible to determine the original source of infection or the line of spread from area to area. The constant movement of troops from one place to another made epidemiologic studies very difficult, if not impossible. The throwing together of so many men from so many different countries might easily have permitted a disease from some remote country to be introduced.

There were three general types of the disease: First, relapsing, either regular or irregular; second, one single short illness resembling influenza; and third, a continuous fever extending over longer periods and suggesting typhoid or paratyphoid. In the American forces in 1917 and 1918, there were 241 cases of trench fever. If one includes the pyrexias of uncertain origin, the P. U. O. of many reports, the number rises to a great height. In one year covering 1918 and part of 1919, there were 21,939 such cases. The disease was transmitted by the body louse, and when delousing facilities were fairly adequate, the rate dropped rapidly. Such facilities were afforded on the first of February, and in this month the rate dropped to less than one-half of that in January; in March it was about one-quarter of the January rate.

The return of so many soldiers to civil life will probably result in distributing foci of infection throughout the country, although every precaution has been taken to see that troops are thoroughly deloused before embarkation and demobilization. Nevertheless, the possibility of long latent periods and late relapses, as well as the power of the body lice to take up the virus during the late periods of the disease, must be borne in mind. At the writing of this review I have not noted any reports of the disease in the United States, but next year one can report on this subject with a great deal more certainty.

Typhoid Fever. TYPHOID IN THE LARGE CITIES OF THE UNITED STATES. The decline of typhoid is graphically shown up in the seventh

¹⁹⁰ Journal of the American Medical Association, September 13, 1919, p. 807.

annual report¹⁹¹ of its occurrence in American cities. Sixty cities were included in the summary. In 9 cities having a population of more than 500,000, Chicago leads with a death-rate of 1.4 per 1000 inhabitants, a remarkable showing from every point of view when one considers that the average between 1906 and 1910 was 15.8. This was nearly cut in half in the period between 1911 and 1915, and shows what can be done in reducing the death-rate from this disease which formerly claimed an enormous number of victims in late youth and early adult life. Boston, Philadelphia, New York and Cleveland follow in order, with reasonably low rates. These cities, and also Detroit and Baltimore, show the lowest rate yet reached in their sanitary history. Baltimore has gone from a 35.1 rate in the 1906 to 1910 period to a rate of 12.2. The purification of the water supply probably had a great deal to do with this, but the lowering is remarkable when one considers the large negro population and also the fact that the neighboring rural districts are rather heavily infected. The best reports were made by the New York Health Department, in the *Weekly Bulletin*. Both the weekly and monthly bulletin of this department are very valuable journals, but neither are as interesting as they were formerly, due to dropping an unusually able editor, but they still can serve as models for other health departments. The trouble with most health department bulletins is that they are late in appearing, many times several months overdue, so that the information lacks seasonal interest. One of the things which the New York Bulletin has insisted upon is the immunization of nurses and others in hospitals who are particularly liable to be exposed to infection, and this is a point which should be brought officially to the notice of all hospital authorities everywhere.

The most remarkable lowering of record is Pittsburgh, which has dropped from the 1906 to 1910 period of 65 to a rate of 9.8. The smaller cities show up pretty well in the second group from 300,000 to 500,000 population. New Orleans and Washington still continue to show the largest number of deaths from typhoid.

In the fourth group, cities from 125,000 to 200,000 population, Richmond shows a death-rate of 65.3, a very curious and unfortunate rise. From a point of 34 they succeeded in more than cutting this in half between 1911 and 1915. In 1916 the rate was 24.1, followed by an exceptionally good year, with only a rate of 7. In 1918 it was jumped to 65.3. One or more special factors must have operated and should have immediate searching investigation. The rates are, as a rule, always lower in Northern cities. This is due partly to the shorter warm season and partly to the difference in the population. The large number of negroes and illiterates in the South, coupled with, for the most part, deficient and exceedingly primitive sewage disposal, makes the rate higher than it should be in a country boasting civilization.

TYPHOID FEVER TRANSMITTED THROUGH THE BREAST MILK OF THE MOTHER. Examples of this form of infection are exceedingly rare, although one might readily expect infection to take place in this manner,

¹⁹¹ Journal of the American Medical Association, April 5, 1919, p. 997.

inasmuch as Lawrence, in 1917, demonstrated the typhoid bacilli in the breast milk in a nursing mother of twenty-three years of age, who was ill with the disease.

Heiman¹⁹² has reported an instance in which a mother, aged twenty-nine, was admitted to a hospital suffering with typhoid fever after about two weeks. She was acutely ill, ran a definite, rather severe form of the disease, but finally recovered in the fifth week. Typhoid bacilli were recovered from the blood and the Widal reaction was positive. Typhoid bacilli were also recovered from the milk, corresponding in every respect to the typhoid organism.

Two days after the admission of the mother, the child was brought to the pediatric service suffering with the same disease. The infant was eight months old, and had been breast-fed until two weeks before admission to the hospital, having been weaned on account of the mother's illness. The blood showed the presence of typhoid bacilli and the Widal reaction was positive.

SURGICAL TREATMENT OF TYPHOID CARRIERS. Nichols, Simmons and Stimmel¹⁹³ have reported the results of the surgical treatment of 6 chronic typhoid carriers. One was a urinary carrier, and was cured by nephrectomy; three intestinal carriers were cured by cholecystectomy; and two intestinal carriers were not cured by cholecystectomy. They believe that the so-called urinary carriers of typhoid are really kidney carriers and in case the affected kidney is functionless, there would seem no objection to surgical interference. The intestinal carriers are of two kinds: first, those in which the gall-bladder alone is infected, and in these a cure may be effected by removing it, but when the gall-bladder and bile passages are both infected, a cure does not result from cholecystectomy and the bacilli continue to find their way into the intestinal tract.

A New Paratyphoid Bacillus. It seems very strange indeed that the typhoid group has not been greatly extended, but up to the present the bacteriologists have contented themselves with typhoid, paratyphoid A and paratyphoid B. Hirschfeld¹⁹⁴ has made a study of what he calls paratyphoid C, which was isolated from febrile cases occurring in the Serbian army. The Serbian army had been vaccinated by using vaccines of the Pasteur Institute containing typhoid, and the paratyphoids A and B. This did not furnish a protection for the disease as found in Serbia, and infections with the paratyphoid C were found in cases so vaccinated and some of these terminated fatally. Hirschfeld has prepared a vaccine which has been used to furnish the desired immunity.

Chicken-pox. FATAL EPISTAXIS FOLLOWING CHICKEN-POX. Epistaxis may follow almost any infection at times and J. C. Jones¹⁹⁵ gives a brief history of a colored man, aged twenty-five, who actually died from nasal hemorrhage. The patient had been admitted to the hospital

¹⁹² Journal of the American Medical Association, September 20, 1919, p. 913.

¹⁹³ Ibid., August 30, 1919, p. 680.

¹⁹⁴ Lancet, February 22, 1919, p. 296.

¹⁹⁵ Laryngoscope, February, 1919, p. 101.

three weeks before for chicken-pox and the disease ran a normal course. For six days previous to his entering the otological service, he had had daily nosebleed, which was easily controlled by an adrenalin spray of 1 : 1000. Two days before being transferred, he had had a severe pain in the left ear which was followed in a few hours by a very profuse hemorrhage. There was no history of any bleeders in the family and the patient had never been subject to nosebleed before. In spite of the use of normal horse serum, thromboplastin, the intravenous administration of 450 c.c. of a 5 per cent. solution of acacia and normal salt solution, the patient continued to bleed and finally died.

Influenza and Epistaxis. Goldstein¹⁹⁶ had occasion to study 60 cases of epidemic influenza in which epistaxis occurred as a prodrome or as an early symptom in the course of an attack. The bleeding seemed to be in the septal side of the nose and in the course of the septal artery. The *Streptococcus hemolyticus* was identified as the active factor, and Goldstein believes that cases in which epistaxis occurred were those in which very severe symptoms and more severe complications developed. Subsequent hemorrhages often appeared in other localities of the respiratory tract and also in the other organs of the body and he also noted that pneumonic complications were apt to ensue. Cases treated by the administration of normal horse serum all eventually recovered while those untreated were often attended with a fatal result.

This seems to be at variance with the experience in Baltimore, where bleeding from the nose early in the disease was regarded as rather a favorable thing, certainly in children. In my own experience there were no serious complications in any of the children who had more or less profuse epistaxis, either as a prodrome or on the first or second day.

THE ASSOCIATION OF HERPES ZOSTER WITH VARICELLA. There is a tendency of medical observers to try to associate herpes zoster with other diseases. There has been a certain amount of writing attempting to show that the disease bears some relation to poliomyelitis, but it is more commonly associated with varicella. Bokay, of Budapest, in 1892, suggested that the virus of chicken-pox might, in certain circumstances instead of producing a generalized eruption cause a zoster eruption. Subsequently, in 1909, he reported 9 cases in which one member of a family of a patient in a ward developed herpes zoster and at intervals varying from eight to seventeen days, one or more members of the same household developed chicken-pox.

Since attention was called to this, there have been something like 50 cases reported by Hepworth, Orr, Heim, and others. In all the reported cases the chicken-pox eruption appeared in from eight to twenty-one days after contact with a case of herpes zoster. The converse condition, that is, chicken-pox followed by herpes zoster has not been observed so frequently, but Hepworth, Aikman, and others, have noted this and reported it. With the assumption that the chicken-pox was a source of infection, the disease developed within from two to five weeks after exposure, and lastly, there is the observation that herpes

¹⁹⁶ Laryngoscope, August, 1919, p. 447.

zoster, in addition to the ordinary lesions, may show eruptions similar to chicken-pox. Quite a number of such occurrences have been reported under the title of herpes zoster generalizatus.

Low¹⁹⁷ has reported several instances and quoted the references from the literature. He makes an interesting suggestion that the chicken-pox is probably a blood infection and that cases showing both herpes zoster and chicken-pox-like eruption, the virus probably starts in the nerves passing through the nose, along the lymphatics and the meninges into the cerebrospinal fluid and from thence through the ganglia into the central nerve trunks. When chicken-pox occurs later, he suggests that it gets into the general circulation. The virus of chicken-pox is doubtless filtrable, and it would be exceedingly interesting to have observations on this point with both diseases with the modern technic.

Heim has reported an instance of simultaneous epidemics of herpes zoster and chicken-pox in Budapest.

The immunity to chicken-pox is usually complete for life, but if it is due to some infection one would think the immunity would be reciprocal. Low, and others, have seen cases in which an adult developed herpes zoster who had the history of having had chicken-pox in childhood.

Vaccines. THE VACCINATION OF TUBERCULOUS PATIENTS AGAINST SMALLPOX. There has always been an apparently widespread, but perhaps groundless, objection to using smallpox vaccination in patients suffering with tuberculosis. As far as I know, there is no authoritative literature on the subject, and in my rather extensive article on Vaccination in *Forchheimer's Therapeutics*, the subject was not included. A contribution along this line is therefore considered with great interest.

Mark¹⁹⁸ had occasion to vaccinate 200 patients on account of a virulent case of smallpox breaking out in an institution. The patient in question had been mingling with all the others for about ten days prior to the eruption and the making of the diagnosis. Of the 200, 70 were in the first stage, 83 in the second and 47 in the third. The majority had some activity and some elevation of temperature. Among these were 40 who had never been vaccinated before, or in whom the vaccination did not take. Three weeks after the vaccination it was found that there were about 50 per cent. of positive takes, 15 per cent. had sore arms and 8 per cent. were slightly affected. In no instance did the patient complain of any conditions pertaining to the chest that could in any way be traced to the vaccination. The majority of the patients were examined three or four weeks afterward and in no case were there any changes incompatible with the usual course of tuberculosis. The smallpox patient who was the cause of the vaccination made a normal recovery and was discharged from the institution in three months as an apparently arrested case of the disease.

From this experience of Mark's it would seem to me to be a perfectly safe thing to vaccinate patients suffering with tuberculosis should occasion arise for it.

¹⁹⁷ British Medical Journal, January 25, 1919, p. 91.

¹⁹⁸ Journal of the American Medical Association, March 8, 1919, p. 704.

TREATMENT OF BRONCHIAL ASTHMA WITH VACCINES. Last year Walker showed that 48 per cent. of patients with bronchial asthma were sensitive to some type of protein. More recently, he¹⁹⁹ has reported his study of 178 individuals treated with bacterial vaccines. Twenty-eight of these patients were sensitive to protein and were treated with the organisms to which they were sensitive. The remaining 150 patients were not sensitive to any protein with which they were tested. The bacteria usually employed were the *Staphylococcus aureus*. Seventeen were treated and 10 were relieved, 6 were markedly improved and 1 was not benefited. One received the *Staphylococcus albus* in addition to the *aureus*. This patient was relieved. Two patients were sensitive to the *Staphylococcus aureus* and the *Streptococcus hemolyticus*, and both were relieved by treatment with the *Streptococcus hemolyticus*. Of the 28 patients sensitive to bacteria, 75 per cent. were relieved and 21 per cent. were improved.

Certain other groups were noted in some of the other cases. In patients who were non-sensitive, organisms recovered from the sputum were generally employed. Seventy-five such patients were treated with vaccines made from culture of their sputum on plain agar. The predominating organism was usually the one selected for treatment. Of these, 46.6 per cent. were relieved and 16 per cent. were improved. Twenty-four non-sensitive patients were treated by culturing their sputum in dextrose bouillon, using only the streptococci; 37.5 per cent. were relieved and 25 per cent. were improved. Thirty-five non-sensitive patients were also treated with vaccines obtained by culturing the sputum both ways. Of these, 31.4 per cent. were relieved, and 23 per cent. were improved. Of 16 non-sensitive summer asthmatics treated with vaccines, 31.2 per cent. were relieved and 25 per cent. were improved.

Putting all of these figures together, 40 per cent. were relieved and 20 per cent. were improved. The age of the onset of the asthma, the age of the patient and the duration of the asthma in the sensitive cases had little to do with prognosis, but, with the non-sensitive cases the older the patient is when the asthma begins and the older he is when treatment is taken, the more unfavorable the prognosis. The length of time that relief was secured in the non-sensitive cases varied, some patients remaining free after the vaccines had been discontinued for many months, others for only a month or two, while some required the constant use of vaccine to keep them free from asthma.

This is a method of treatment well worthy of trying in cases which do not respond promptly to the other methods of treatment, and this comprises rather a large group of cases.

THE DETERMINATION OF THE PROPHYLACTIC AND CURATIVE VALUE OF BACTERIAL VACCINES. We are in a curious investigating period with reference to vaccines and serums, a period which bears the same relation to medical history with regard to these agents as the fifteenth to twentieth century did with reference to vegetable and, to a large extent, to chemical preparations. Out of the bewildering maze of observations

¹⁹⁹ Archives of Internal Medicine, February, 1919, p. 220.

and recommendations made over a period of over four hundred years, there were brought forth a few potent and valuable drugs—digitalis, belladonna and others; the direct contribution of a large series of observations with countless preparations, most of which have been rightly discarded, perhaps a few of great value have gone along with the discards. At present the same indiscriminate, haphazard, senseless methods are being employed in working out the values of vaccines and serums. Truly, if ever, fools rush in where, if not angels, at least wise men, fear to tread. Eventually out of this mass of experience will be crystallized a few serums and a few vaccines of definite value.

A timely article, and one which should be read by every physician, is that of McCoy,²⁰⁰ Director of the Hygienic Laboratory of the Public Health Service. His article is written with special reference to influenza and he calls attention to the inadequacy of the evidence produced to support the claims of certain preparations. He gives as the commonest source of error that due to the employment of a vaccine in an institution or in a group not in an institution after cases of the disease have appeared. A certain number of the group develop the disease. Prophylactic vaccinations follow and it may be thought that no new cases develop after the so-called immunization has been completed. Tabulating the results in the vaccinated and unvaccinated makes an impressive array, but when one considers that some of the cases develop before the vaccinations were started, and that in all probability the remainder would not have had the disease whether vaccinated or not, the figures lose their value. For example, in a large group of hospital attendants approximately one-third were vaccinated and all remained free from the disease, while the remaining two-thirds unvaccinated all developed the disease, a striking instance of the value of vaccination until the fact is brought out that the vaccinations were begun only after practically all of the two-thirds mentioned had become ill, and it is well known that it is rare for more than two-thirds of any group to develop influenza.

Along similar lines are the facts that are brought forth regarding the efficiency of vaccination in large groups of persons in civil communities. It was shown that but 2 per cent. of those who had been vaccinated developed the disease, while in the community at large the incidence had been about 5 per cent. On the surface these figures look significant, but when one considers that the vaccinations had not been completed until the community had suffered from the epidemic for about five weeks and that about one-half of the 5 per cent. of cases had occurred before the vaccinations were finished. Omitting these, there remained few cases in the large unvaccinated group as compared with those that had occurred among the vaccinated.

A second source of error is vaccination of an entire group, and to interpret the failure of the disease to appear or spread as evidence of protection. Comparisons made with institutions or similar groups where there were no vaccinations or where the history of the disease was identical with that which occurred in vaccinated groups show the

²⁰⁰ Public Health Reports, May 30, 1919, No. 22, xxxiv, 1193.

fallaciousness of such arguments. The commonest error, however, is to draw conclusions from a very small number of observations. For example, one individual claimed that he had been protected by vaccination because he had been exposed to influenza patients many times and took no precautions other than the vaccination and he had not developed the disease. Evidence of this sort should be given no consideration. The majority of people escaped the disease whether exposed to it or not and without reference to their being vaccinated.

The examples of cure by vaccine are not more remarkable than the similar number of cures and rapid terminations without the use of vaccine. By using the vaccine on alternate cases over large series some idea of its value might be obtained, but in the only example with which McCoy is familiar where this was done he states that no better results were secured in the vaccinated than in the control group.

In regard to pneumonia, there seems to be considerable difference of opinion regarding the diagnosis. For example, in a certain large hospital in one service, about 60 per cent. of the cases admitted were diagnosed pneumonia and all were treated with vaccine, with a mortality of about 10 per cent., while in the same institution, on another service, about 15 per cent. of cases were diagnosed pneumonia, with a mortality of 40 per cent. In this instance, the actual number of deaths was approximately the same, but the vaccine treated cases showed a much lower case mortality in the pneumonias. Taking everything into consideration, it may be assumed that the difference was due not to actual conditions, but to the question of diagnosis.

The only real way in which to secure promptly acceptable evidence of the value of a vaccine is to use it in a part of a group, using the remainder as controls, and with age, sex and conditions of exposure being the same in the two groups, and to use it before the susceptible individuals have been eliminated by having had the disease.

DETOXICATED VACCINES. One of the stumbling blocks in the use of vaccines is that many of them are so toxic that it does not seem possible to use sufficiently large doses to produce a specific immunity without at the same time incurring the danger of causing untoward effects. This has led to a constant search for some method of destroying the toxic properties of the various vaccines without impairing their power to put in action the immunizing processes. A very considerable amount of work has been done on the tubercle bacillus and on others, and various methods have been tried, one of the most successful being the procedure of Besredka of sensitizing the vaccines by exposing them to a homologous serum at body temperature. Subsequently, Le Moignic and Pinoy found that vaccines suspended in oil were less toxic than suspensions in other fluids and this has led to the rather extensive use of lipovaccines.

Two articles of interest in this connection are by Thompson²⁰¹ and by Lees.²⁰² Thompson found that Gram-negative germs, particularly the gonococcus and catarrhal organisms, are readily soluble in weak alkalis, such as normal soda solution. The Gram-positive organisms

²⁰¹ *Lancet*, June 28, 1919, p. 1102.

²⁰² *Ibid.*, p. 1107.

are not so soluble. Taking advantage of this fact, it was found that by treating the germs with the alkaline solution and subsequently precipitating with weak acid, such as sodium phosphate, the supernatant fluid was found to be highly toxic, while an emulsion of the washed precipitate was scarcely toxic at all. An emulsion of this precipitate, or what Thompson calls stroma, shows highly antigenic power. He believes that the gonococcus and, indeed, all germs consist of stroma and toxin, but both constituents are soluble in alkalies, but the stroma or bulk of the germ, is thrown out of solution by an acid leaving the toxin in solution. Some germs precipitate more rapidly than others when acid is added; for example, the gonococcus, streptococcus, pneumococcus and influenza bacillus are precipitated very rapidly. On the other hand, the typhoid bacillus, Friedländer's bacillus and the colon bacillus can only be precipitated with great difficulty. Both the stroma precipitate and the toxin were found to be colloid solutions, since the alkaline solutions were incapable of passing through a dialyzing capsule.

The dose of the gonococcus stroma which could be borne is enormous. Up to ten thousand million organisms have been given with impunity. Just how far this method will lead us in solving the practical problems of immunity is doubtful. The method has been used on some 150 persons, who were inoculated with a mixture composed of pneumococci, *Micrococcus catarrhalis*, Friedländer's bacillus, streptococci, *Bacillus septis*, and Pfeiffer's bacillus, giving two doses, the first 1500 millions and the second 3000 millions. In all of these individuals, with one exception, no influenza or catarrhs have been noted.

Lees has reported his results in a series of cases using the gonococcus vaccine. The vaccine was used in cases with epididymitis in which there was a very slight local reaction, the temperature rose from a degree to a degree and a half, but never lasted more than twenty-four hours. There was a remarkable disappearance of the gonococci in most cases and in two or three days they were almost always extracellular and showed a tendency to clumping. The tense swelling and acute pains subsided after one or two injections and the results in general regarded as highly favorable. Good results were also obtained in acute prostatitis cases with general involvement and also in simple cases of urethritis.

LIPOVACCINES. In a plain, short article on this subject, Whitmore²⁰⁸ calls attention to the fact that there are two principal methods of preventive inoculation: One in which the modified living virus is used, as in smallpox inoculation; and the other in which the killed bacteria suspended in salt solution are employed, as in typhoid vaccination. He also calls attention to the fact that to obtain proper results large amounts must be used and it is not possible to give a sufficient number of killed bacteria in one dose without producing severe general reactions. He lays great stress on the difficulty of getting a civil community to submit to three doses of typhoid vaccine and states that only in the Army where it is compulsory is this done. I think Colonel Whitmore is entirely in error regarding the civilian community and three doses of vaccine. I

²⁰⁸ American Journal of Public Health, July, 1919, p. 504.

have yet to see the first patient object to the third dose, even after there had been a reaction, and I am sure this is the experience of physicians in civil practice.

The basic work of using oil suspensions was done by LeMoignic and Pinoy;²⁰⁴ Archard and Foix²⁰⁶ and LeMoignic and Sezary. They showed that organisms given in oil suspensions are more slowly absorbed and that it was possible to give the entire amount in one dose, and that the immunity reactions were as good as when the bacterial material was suspended in salt solution and given in divided doses. Whitmore and his associates succeeded in making the triple typhoid vaccine into a satisfactory lipovaccine and this is now the official one for use in the army. They have also made a pneumococcus lipovaccine, the use of which is voluntary in the army. In addition to these, a meningococcus lipovaccine and a triple dysentery lipovaccine are being tried out in the army, and they have also developed a streptococcus lipovaccine, a cholera lipovaccine and a plague lipovaccine.

The vaccine keeps for at least a year and can be carried in stock for a reasonable time. It is possible to give a very large dose of bacteria in the lipovaccines without severe reaction, it is possible to include two or more organisms in the single dose of vaccine. It should be borne in mind that these lipovaccines while having great advantage for use for protection against disease, do not seem suited for use in the cure of disease.

Yellow Fever. Etiology of Yellow Fever. Noguchi²⁰⁸ has started a series of contributions on the etiology and pathological findings of yellow fever, the result of studies made in the Yellow Fever Hospital in Guayaquil, by the Yellow Fever Commission of the International Health Board. The disease so encountered in their studies presented the clinical features which Noguchi has gone into, but which need not detain us here. He²⁰⁷ also gives a very satisfactory description of the pathological changes and follows with a second article, on the etiology of the disease. Studies were made by drawing the blood from the veins at various stages of the disease, but chiefly during the first week, and injecting it, before coagulation, into the peritoneal cavity in mammals, or into the pectoral muscles in birds. Ten cubic centimeters of blood were taken and distributed in from one to four animals in each instance. Observations were made on the ringtail monkey, rabbit, guinea-pig, cat, dog, donkey, guatusa, which is an animal resembling a rabbit, the comadreja, resembling an opossum, and the ozo-melero, or two-toed sloth. Of the birds, he used pigeons, paloma de tierra or ground dove, the blue bird, blackbird, parrakeet, reedbird, a bird called the blancos, which is like a magpie, but white, and two others of the names of mantas and diostede. All the animals inoculated were kept under observation at least one month before being discarded as negative, even when no symptoms were observed. If more than one animal of the series receiving the same blood became febrile, one was killed for observation and further passage made in the same species of animals. This was exceed-

²⁰⁴ Compt. rend. Soc. de biol., Paris, 1915, lxxix, 201, 352.

²⁰⁶ Journal of Experimental Medicine, 1919, xxix, 547.

²⁰⁸ Ibid., p. 209.

²⁰⁷ Ibid., p. 565.

ingly important as it was sometimes the only means by which it was possible to reproduce an experimental condition resembling yellow fever on the third animal passage. None of the birds showed any definite symptoms when first inoculated with the blood of yellow fever patients, but upon subsequent injection of the organ emulsion of a guinea-pig with the experimental yellow fever, that is that which was induced by inoculation, parrakeets, mantas, blackbirds, reedbirds, and paloma de tierras died within twenty-four to seventy-two hours, but the only lesion was a hyperemia of the visceral organs. Pigeons, blue birds and toucans showed no definite reaction. This rather rapid death following the second injection may have been due to anaphylaxis. These and some of the other animals were not sufficiently susceptible to enable the yellow fever virus to multiply, although it is possible that some of them had an extremely mild or atypical form of infection.

Most of the other observations were made upon guinea-pigs. These animals showed a group of symptoms and lesions closely resembling those observed in the disease in human beings were induced in a limited number of instances. Of 74 guinea-pigs inoculated with blood from cases of yellow fever, 8 pigs, representing 6 different cases, developed symptoms, which consisted of a marked rise of temperature after a period of incubation averaging three to six days, with simultaneous suffusion of the capillaries, particularly of the conjunctivæ and soles, a preliminary hyperleukocytosis followed by progressive leukopenia, the early appearance of albumin and casts in the urine, which gradually diminished in volume as the disease progressed. The fever lasted a few days, dropping first to normal and then usually to subnormal. In this period there was more or less jaundice noted, first in the scleras and then in the skin and urine. During this period there may be also hemorrhages from the exposed mucous membranes. At autopsy there was marked jaundice of all the tissues, the liver was fatty, kidneys hyperemic together with hemorrhagic spots in the lungs and gastro-intestinal mucosa.

A minute organism which closely resembles in morphology the causative agent of infectious jaundice (*Leptospira icterohemorrhagiæ*, Noguchi), was demonstrated in the blood, liver and kidneys of the animals infected with blood of yellow fever patients, and these organisms were further found to produce similar symptoms and lesions upon further passage into normal guinea-pigs. Noguchi had named this organism provisionally the *Leptospira icteroides*.

A third report²⁰⁸ has been made on the symptomatology and pathological findings in animals experimentally infected. The infection had been observed in guinea-pigs and monkeys and may be induced either by injection into the peritoneal cavity, into the circulating blood or the subcutaneous tissues, or by application to the scarified, depilated surface of the skin, on mucous membranes, or by feeding the animal on infected tissue or culture. The incubation period varies according to the mode of infection and the quantity of virus introduced. With large amounts inoculated intraperitoneally or into the circulation, inactivity, anorexia and hyperleukocytosis make their appearance after forty-eight hours,

followed by a rise in temperature and slight albuminuria within the next twenty-four hours. When subcutaneous inoculation is done the symptoms do not appear until the fourth or fifth day, that is seventy-two to ninety-six hours after the injection and if very small amounts of virus are used, several more days are required. When the virus is introduced through the skin or by mouth, a much longer period, from six and sometimes as long as twelve days is needed for the incubation.

The course of the disease in dogs is similar to that of guinea-pigs. Ring tail monkeys were found to be refractory, but marmosets proved to be susceptible, four being fatally and one mildly infected. There are certain differences in the various animals, which, while they may be important from the scientific side, have comparatively little interest for the general reader. For example, in dogs the subcutaneous hemorrhages almost never occur and the lungs usually show a few minute ecchymoses and so on. The symptoms and lesions observed in the animals parallel very closely those noted in yellow fever in human beings. The disease was also produced by using primary cultures of the organism.

Another study by the same author²⁰⁹ is on the subject of guinea-pigs acquiring an immunity against the *Leptospira icteroides* after inoculation of blood of yellow fever patients. Of 74 pigs inoculated, but 8 developed the disease. There were a number of instances in which the inoculation of yellow fever blood induced a temporary febrile reaction on the fourth or fifth day, followed in some cases by a slight jaundice, but with a rapid return to normal. Most of these pigs when inoculated later with an organ emulsion of a passage strain of *Leptospira icteroides* resisted infection. It so happened that a great many patients suffering with severe malaria were brought to the Yellow Fever Hospital on the chance that the case might be one of yellow fever. These cases were used for observations or transmissions of the disease without waiting for a diagnosis in order to save time. The animals which had been inoculated with the blood of malarial patients or normal guinea-pigs, had died of the typical experimental infection after receiving the inoculation. It seems therefore justifiable to believe that the non-fatal or abortive affections which followed the inoculation of blood of yellow fever patients into guinea-pigs produced an immunity and that they had actually passed through an infection with the same organism or one closely related to it, as that which had been used for the second experiment.

In another contribution Noguchi²¹⁰ has summarized the result of his studies on the serum of a number of persons recovering from yellow fever. For this purpose blood was drawn from the median basilic vein of the patient and the serum mixed with *Leptospira icteroides* in the form of organ emulsion from infected guinea-pigs, or with a culture of the organism and injected intraperitoneally into guinea-pigs. The Pfeiffer reaction was studied under the dark field microscope and was observed in 15 of 18 convalescent cases studied, or approximately 83 per cent., whereas serum from 10 non-immune soldiers and from 2 malarial patients gave uniformly negative results. In some of the guinea-pigs which

²⁰⁹ Journal of Experimental Medicine, 1919, vol. xxx, p. 1.

²¹⁰ Ibid., p. 9.

received the serum of the yellow fever convalescents, there was sufficient protection to prevent a fatal infection, while the control animals all died with typical symptoms. In these observations of immunity reactions, Noguchi states that it appears highly probable that the *Leptospira icteroides* was etiologically related to yellow fever.

Still another contribution by the same observer²¹¹ deals with the cultivation, morphology, virulence and biological properties of the *Leptospira icteroides*, the methods being similar to those employed in growing the *Leptospira icterohemorrhagiae* of Inada and Ido. The principal medium consisted of a mixture of one part of rabbit or other animal serum, of three parts of Ringer's solution, used in combination with a liquid form and a form made semisolid by adding melted neutral agar, the liquid half of the medium being superimposed on the semisolid half in a tall culture tube such as that used in the cultivation of spirochetes. From one-half to 1 c.c. of citrate blood was drawn from the median basilic vein of a patient with the lower or semisolid portion of the medium, while the latter was still in the fluid state and the mixture allowed to solidify by cooling. The fluid medium was then poured over this and about the same quantity of the same blood introduced. A layer of paraffin oil was finally added to cover the surface. Cultures were made from 11 cases of yellow fever with only three successful isolations of the leptospira, and using the organisms so obtained it was possible to produce fatal infection in guinea-pigs. Employing the same method, but using the blood from infected animals, the growth was also obtained. It required a rigid technic, inasmuch as the leptospira in yellow fever cases is extremely sensitive to any alien microbic intrusion, and does not survive even the slightest contamination in culture. The organism itself is extremely unstable, which accounts for the negative results in many instances. The organism is described as a delicate filament measuring about 4 to 9 microns in length and 0.2 micron in width along the middle portion. It tapers gradually toward the extremities, which end in immeasurably thin sharp points. The entire filament is not smooth but is minutely wound at short and regular intervals, the length of each section measuring about 0.25 mikron. The windings are so placed as to form a zigzag line by the alternate change of direction of each consecutive portion at an angle of 90 degrees.

It cannot be seen in translucent light, but is quite visible in the properly adjusted dark field illumination. It is actively motile, vibrates, rotates, and has a rapid bipolar progression with sometimes twisting apart of the filaments. When it encounters a semisolid substance, it penetrates the latter by a boring motion, and while passing through it the body assumes a serpentine aspect with few undulations, the elementary windings undergoing no modification. It may change its course and at almost any angle when passing through a semisolid medium. In fluid medium it is usually bent in the form of a graceful hook, and, when rotating, the organism generally proceeds in the direction of the straight end, the hooked end apparently being used as a sort of rear propeller. When extricating itself from an entanglement, the same hook end seems to act like the front propeller of an airplane.

²¹¹ Journal of Experimental Medicine, 1919, p. 13.

Many specimens were observed in which both ends were hooked, the organism then rotating in a stationary position unless one hook is larger and more powerful than the other. The organism is difficult to stain with the ordinary dyes, but may be made distinct by osmic acid fixation and one of the Romanowsky stains (Giemsa, Wright, Leishman). The beauty of the organism as it appears before the dark field illumination is never well retained in a stained preparation, even in the best specimens, and in the latter it appears as almost a totally different organism.

The organism grows best when there is a supply of oxygen, but not too much. In the solid medium it will grow within a zone or layer to which a trace of oxygen can still penetrate, but no deeper. It grows best at a temperature of 37° C., but the organism will remain viable much longer at a temperature of 25° to 26° C., and no organism is obtainable at a temperature above 42° C. or below 10° C. It shows a particular preference for semisolid medium, such as is provided by the presence of agar or by loose fibrin. They entangle themselves in the substance in large numbers and move about very actively. In such a medium there is continuous multiplication. This peculiarity may apparently account for its predilection for the parenchymatous organs, such as the liver and kidney. The organism multiplies through transverse fission. It is non-sporebearing and offers little resistance to the action of heat, desiccation, putrefaction or disinfectants. Heated to 55° C. for ten minutes, or freezing and thawing kill the organism, and complete desiccation promptly destroys its vitality. In the presence of other bacteria, it is destroyed in a short time. The more numerous the bacteria, the quicker the disappearance of the leptospira. Hence, in decomposing excreta or urine, sewer or stagnant water, or in contaminated foodstuffs, no leptospira can be found twenty-four hours after being introduced into them.

There are certain contaminating fungi or non-putrefactive and non-acid-producing bacteria, sometimes bacilli and sometimes cocci that have been found growing in the cultures without seriously interfering with the viability of the leptospira. When the pure culture of the organism is poured into a cup of sterile distilled water and left unprotected from the air or dust, the leptospira has survived several days, but finally disappeared, partly on account of lack of nutrition and partly because of bacterial growth. Introduced in large quantity in fecal matter and kept at room temperature, they disappear within a few hours. It is very interesting to note that the *Leptospira icteroides* can pass through the pores of filters. By the use of Berkefeld filters V and N and suction of a water pump, it was possible to filter an emulsion of a guinea-pig experimentally infected with the strain seven days previously. The clear filtrates which were bacteriologically sterile were inoculated intraperitoneally into normal guinea-pigs in doses of 10 c.c. each. Both animals used for this purpose came down with typical symptoms after seven and a half and eight days respectively. In the blood of these animals a small number of leptospiræ were demonstrated twenty-four hours before death. The organisms were also present in the emulsions of the liver and kidney, and upon further passage to guinea-pigs the emulsion proved to be infectious.

The seventh contribution²¹² deals with the presence of the organism in the blood. The number of *Leptospira icteroides* found in the blood of yellow fever patients is so small that a prolonged examination was necessary to discover even one organism, although positive transmission had been obtained by the injection of the blood into guinea-pigs. It is probable that lack of time devoted to the search was one of the reasons, so that the report as given should be regarded as a preliminary account of what was accomplished, under which circumstances the investigation was carried out.

In the blood and organs of the various animals experimentally infected with the *Leptospira icteroides*, it was easier to demonstrate. The results obtained by staining the blood film preparations showed about the same number of positive results, but this may have been partly due to the quality of the dyes.

An eighth study²¹³ deals with the presence of the organism in wild animals in Guayaquil. By inoculation of guinea-pigs intraperitoneally with emulsions of wild rats and mice, it was found that about 67 per cent. of the wild rats tested harbored in their kidneys a leptospira which produced in guinea-pigs symptoms and lesions identical with those produced by *Leptospira icterohemorrhagiæ* derived either from patients suffering from infectious jaundice in Japan or Europe, or from wild rats captured in New York. Immune serum was prepared in rabbits by injecting different strains of the Guayaquil leptospira. These sera had marked agglutinating and disintegrating influence upon the homologous strains, and also, but often to a less pronounced degree, upon the strains of *Leptospira icterohemorrhagiæ* from other sources. Pfeiffer's phenomenon was found to be positive and protection was demonstrated against infection with virulent cultures of strains of *Leptospira icterohemorrhagiæ*. The same sera had no effect, or at most a very slight one, upon the *Leptospira icteroides*. Guinea-pigs inoculated with *icteroides* strains were not noticeably protected by the immune serum prepared with a Guayaquil rat strain. The conclusion was reached that the *Leptospira* isolated from the kidneys of wild rats and mice in Guayaquil belongs to the group of *Leptospira icterohemorrhagiæ*, and differs from the *Leptospira icteroides* in its immunity reactions.

If these observations of Noguchi's can be confirmed, and most of the work of this talented investigator has stood the test of time, medical science will have made a large step forward in the problem of yellow fever. The practical control of the disease following the method used by Gorgas in Havana, and by Oswaldo Cruz, in Rio, has been most satisfactory, but there is much to be learned about the disease and these investigations will open up numerous fields of inquiry.

The Weil-Felix Reaction in the Diagnosis of Typhus Fever. In 1915, Weil and Felix²¹⁴ studied an outbreak in east Galicia which resembled typhoid fever, but in which the typhoid bacillus could not be isolated, either from the blood, stools or urine. These cases were clinically diagnosed as typhus fever and from the urine of one was isolated an

²¹² Journal of Experimental Medicine, 1919, xxx, 87.

²¹⁴ Wiener klinische Wochenschrift, 1916, No. 2.

²¹³ Ibid., p. 95.

organism which was agglutinated in the patient's own serum in a dilution of 1 to 200, but was not affected by serum from typhoid, paratyphoid A or B, or dysentery. The organism was called X_2 and resembled the proteus group, both culturally and serologically. Another strain, called X_{19} , was isolated later and found to be more sensitive to agglutination. The organism was described as a short, thin proteus-like, gram-negative rod, which is slightly motile, forming blue colonies on Conradi-Drigalski medium, and colorless colonies, which later become red, on Endo-medium. It ferments glucose and lactose and produces an acid reaction in litmus milk, followed by curdling; it liquefies gelatin and grows like proteus in plate cultures.

Bengtson²¹⁵ has made some observations on this organism and given a summary of the work of some others. There is a very considerable question of the significance of these organisms and their relation to typhus fever. Both Weil and Felix, and other Austrian authors, as well as certain English authorities, as Craig and Fairley, believe it to be a secondary invader and describe the agglutinating properties of the serum of typhus patients to be due to its presence. The organism has been isolated 44 times from several hundred cases. Other secondary agglutinins have also been described in typhus fever. However this may be, the constancy of the reaction would seem to make it of very considerable value in the diagnosis of typhus fever. Fairley, working in Egypt, demonstrated this. He showed that the sera of 63 out of 65, or 97 per cent. of cases, showed positive agglutination reactions with the organisms; while out of 120 non-typhus cases no positive agglutinations were obtained in a dilution of 1 to 20. In one of their earlier reports, Weil and Felix state that in 126 clinical cases of typhus they had 125 positive reactions and 1 negative, while in 632 control sera from other diseases, including typhoid fever, smallpox, meningitis and relapsing fever, about 12 per cent. showed positive reactions in a dilution of 1 to 25 of the serum, but in practically all agglutination was incomplete and delayed.

The reaction appears during the first week of the illness and is at its height during the second week and during convalescence. The technic of the test is as follows: A freshly grown agar culture is used, the growth suspended in 1.5 c.c. of salt solution, and tests made with 1 to 25 and 1 to 50 dilutions of the serum of the suspected case. In positive cases the agglutination titer should rise from 1 to 25 on the sixth day to 1 to 200 to 1 to 500, or higher, on the twelfth day. If the titer is 1 to 25 on the first test and does not rise higher, typhus may usually be excluded. Jacobitz²¹⁶ believes that the agglutination of the organism is decreased by exposure to a temperature of 60° C. for an hour. Others have used alcoholic preparations which are said to keep for two years. This was suggested by Sordelli. The test has been used in Europe and also in South America, and Bengtson states that she believes that it is destined to be of great practical value as a laboratory aid in the diagnosis of typhus fever.

²¹⁵ Public Health Reports, October 31, 1919, p. 2446.

²¹⁶ Centralblatt für Bakteriologie, I, Orig., 1918, lxxxi, 251.

DISEASES OF CHILDREN.

By FLOYD M. CRANDALL, M.D.

For three years past it has been necessary to say that pediatric literature has been largely curtailed, very little coming from those countries from which we had been accustomed to draw much material. We are, as yet, receiving little from Europe. However, the work in this country, does not seem to have materially diminished. Military medicine still holds a large place in medical journals, but the tendency to revert to the original channels seems to be strong and some excellent work in this department has been reported.

Premature Infants. In recent articles published on the care and treatment of premature infants, two things are evident; that the use of the incubator is becoming less and less popular, and that longer intervals between the feedings are giving better results. Cobb,¹ in a paper read before the New York Academy of Medicine, Section on Pediatrics, states that babies born before the seventh month will usually die within a short time after birth. Occasionally, however, babies as young as six and a half months have been saved and have become vigorous and useful members of the community. He claims the outcome depends upon the baby's vitality and the care it receives. Its vitality depends upon several factors, the most important of which perhaps is the degree of health of its parents, especially its mother and the nourishment she has been able to afford it. The most important factor in the prognosis with reference to vitality, is the degree of atelectasis present. Premature babies invariably have small areas of atelectasis. The lower the vitality, the greater in extent are these areas as a rule. If the baby has the factor of hereditary syphilis, the atelectasis is apt to be an important and determining factor in the inability to respond. If the temperature curve is normal, the baby's chances for improvement are good. If, however, there are wide variations in the temperature, sudden drops with little exposure, and sharp rises with the application of artificial heat, the outlook is less favorable. Few babies less than four pounds in weight have organs sufficiently developed to maintain life.

Treatment consists in maintaining the bodily heat at a steady temperature; and protecting the child from unnecessary irritation and feeding. In the maintenance of an even temperature good results may be obtained in an ordinary crib, properly protected, in a room where the temperature is from 80° F. to 85° F. Fresh air is of the utmost importance and clean air should be admitted all the times. In protecting the child against

¹ Journal of the American Institute of Homeopathy, April, 1919.

irritation by its new surroundings, there should be the least possible handling. Feeding is the real problem. Breast milk is unquestionably the most desired food, if it can be obtained. Not being able to secure breast milk, the author considers whey the most satisfactory substitute to begin with, as it is low in fat and casein. It is also easy to gradually increase the food value of whey by adding small percentages of fresh cream to the whey itself. Since the premature baby takes such a small amount of food at a time (not more than a quarter or half ounce), Cobb feeds them at two-hour intervals for the first two weeks. If the baby, after the first two weeks, does not thrive on artificially prepared food, and the mother has no milk, he suggests a wet nurse. He sometimes uses gavage as a method of feeding those infants who in the beginning seem unable to swallow.

Schwartz² discusses the temperature of the premature child, the temperature of the room, the nourishment, the respiration, the weight, nursing care and, finally, the prognosis. At birth, the premature child has a lower temperature than the normal newborn infant. Variation of less than three-tenths of a degree in the twenty-four hours is the rule, whereas, in the premature, subnormal temperature, with large fluctuations, usually downward, are common. This is the result of the large amount of surface presented to the air in proportion to the weight of the child; to a greatly diminished or almost absent panniculus adiposis; to the diminished amount of food that the premature infant can take and assimilate; and also to the incomplete development of the nervous system, especially of the heat center. To overcome these conditions, we must conserve the body heat by thoroughly rolling up the baby, head and all, and surrounding it with hot bottles; or, if the mother is in bad shape, it may be put in a warm bath (temperature of 100° to 102° F.) and held there. The temperature of the room should be maintained at 78° to 80° F. Breast milk is the only food for the premature, at least for a few weeks and the physician should search the community and induce the neighbors to give a few ounces to make up the amount required. The exact quantity needed is difficult to state. The caloric requirements are surely higher than in the full term child. Authorities place it anywhere from 100 to 160 calories per kilo weight. This is because the body surface is greater than in the normal newborn and, as stated before, the panniculus is less. Yet the difference in the caloric requirement is more apparent than real, for no one will deny that a kilo of a nice, fat, juicy, full-term newborn is an entirely different thing from the kilo of dry skin, muscle, and bones of the premature. However, it may safely be said that after the first week one must give at least eight ounces of breast milk in the twenty-four hours; usually ten to twelve ounces in order to make them gain. One-sixth to one-seventh of the body weight in ounces of breast milk is a safe rule, which must be controlled by daily weighing. Feeding the premature should surely begin within twelve hours after birth. Twenty to fifty grams, about one ounce, of water should be given the first day increasing by an ounce each day, to make them hold their weight.

² New York State Journal of Medicine, May, 1919.

If breast milk cannot be obtained, Schwartz uses a dilution of whole milk, 1 to 4, with milk sugar (a mixture low in fat and high in carbohydrate up to 7 per cent. sugar), or more often an evaporated milk mixture, in which 1 ounce of the evaporated milk is equal to about 2 ounces of ordinary milk. At the end of the first week, about 5 to 7 ounces of cow's milk with 1 ounce of milk sugar in twenty-four hours, usually meets the baby's needs. The feedings are generally given by means of the Breck feeder, especially where the child is too weak to suck.

In sizing up the progress in a premature infant, it must be remembered that a child may be full term yet not ripe or fully developed; in addition to being premature, it may be congenitally weak, with inability to perform the normal functions of life; it may have congenital deformities which further impair its chance to live; the period of rapid development in the last months of uterine life, which these children lose, has to be allowed for by proper and sufficient nourishment; it must be realized that these babies miss the great deposit of mineral salts, especially iron and calcium, which occurs in the last months of pregnancy, and thus regularly become anemic and rachitic.

La Féttra³ discusses the care of premature infants at Bellevue Hospital and suggests wise methods of treatment at home. Of the last 200 cases recorded, 90 babies died on the first day, 28 on the second and third days. Of the 82 remaining, 30 lived to be discharged as sufficiently strong and developed to be cared for at home. Conditions to be dealt with are extreme muscular weakness; inability to swallow or to nurse; subnormal temperature; cyanosis, from fatigue of respiratory muscles, weight of arms or clothing, or insufficient food; extreme susceptibility to all sorts of infection. The author, as do other authorities already referred to in this article, recommends a room with temperature from 76° to 80° F. with humidity between 60 and 70, instead of an incubator. Very feeble infants require extra warmth supplied by hot bottles in the crib. The babe should be handled as little as possible. After the initial sponge bath and oiling, no bath need be given for four or five days in La Féttra's experience. He recommends the Breck feeder, a graduated tube with a rubber bulb at one end and a small nipple at the other, for feeding if the babe can swallow, otherwise gavage. The food employed by La Féttra is one-half breast milk and one-half whey, 1 ounce every one and a half to two hours; increasing to three-fourths breast milk, 1 to 1½ ounces seven or eight times a day after a few days. When breast milk cannot be obtained, he uses 5 ounces of 6 per cent. cow's milk, 10 ounces of whey and 5 ounces of Imperial Granum water to make 20 ounces of mixture, to which is added milk sugar or dextrimaltose from ½ to 1½ ounces. As high as 120 to 170 calories per kilogram is required by the premature infant to obtain a satisfactory gain in weight. Taylor,⁴ in his report of 60 premature infants, favors the four-hour interval tube feeding until the babies are able to nurse properly. Their initial feedings were from 15 to 30 gm. of breast milk, six times in twenty-four hours. He found

³ American Journal of Diseases of Children, July, 1919.

⁴ Ibid.

that babies under 2000 gm. do not nurse well until the end of the first month, while those over 2000 gm. usually took the breast successfully at the end of the first week. Nearly all of his little patients were able to maintain a normal body temperature by the end of the first month. The greatest difference of opinion concerning the care of these babies is in regard to the interval of feedings. Brown and George recommend three-hour intervals; McClanahan, one hour; Opitz, an hour and a half.

Grulee⁶ warns against the danger of sudden rise in temperature in the incubator care of the premature, causing a body temperature of 103° or even 104° F. He advises an oil bath every day.

The Newborn. Taylor⁶ reports his findings in measurements taken within a few days after birth of 250 infants, 125 males and a like number of females. These measurements covered every portion of the body and are reported in tables which, while very interesting, do not lend themselves to the purposes of this article.

A review of recent literature on the newborn is presented by Pearce.⁷ He refers to an article by Tivnen regarding BLINDNESS FROM OPHTHALMIA NEONATORUM who claims that one-eighth of all blindness and one-fourth of blindness among children is attributable to this disease and could have been avoided by a little attention at the right time. Cases occurring before the third day are almost always due to gonococcus infection. He advocated one drop of 2 per cent. silver nitrate solution in the eye to be used routinely as a prophylactic measure. Thompson states that the disease differs in the infant and adult probably because the mother confers a strong degree of immunity on the child. Infection ordinarily starts from the second to the fifth day after birth. Cases occurring before the second day are due to intra-uterine infection, and those occurring after the tenth day are due to secondary infection. Ulceration always means a mixed infection, complications may be the same as those from such infection elsewhere.

In discussing the best method for caring for patients suffering from ophthalmia neonatorum, Derby⁸ favors hospital treatment, the scientific care and feeding so obtained being of sufficient benefit to offset partially the handicap of the ocular trouble. The serious question of the frequent handling for the necessary medication every half hour should be decided by the condition of the infant. If the child loses weight, the eye treatment should be decreased to even one treatment every three or four hours. Of the writer's 77 cases due to gonococcus, 23.4 per cent. were monocular. By placing the patient on the infected side, with hands bound down, infection of the other eye may be avoided. For local treatment, wash the eye with boric acid, and instil a 25 per cent. solution of argyrol. A mild remedy is indicated in the acute stages of the disease to avoid further infection.

Attempts are being made in Massachusetts to place the responsibility when an infant suffers the loss of sight, and some kind of prosecution enforced. In England, midwives are required by law to use measures

⁶ American Journal of Diseases of Children, July, 1919.

⁶ Ibid., May, 1919.

⁷ Ibid., August, 1919.

⁸ Ibid.

for the prevention of ophthalmia neonatorum, but the physician is under no such legal obligation, with the result that a greater number of infected cases occur in the cases attended by physicians than by midwives. Whorton found the gonococcus in 75 per cent. of his cases; Gade in 64 per cent.; and Stadfelt in 54.65 per cent. The germ may persist long after the symptoms have subsided. About 10 per cent. of the cases are due to pneumococci; 5 per cent., to *B. coli*; and 5 per cent., to other organisms. The fundamental plan of treatment of ophthalmia neonatorum is the removal of every trace of pus as soon as it is formed, by the use of weak antiseptics such as boric acid, potassium permanganate (1 to 5000) or corrosive sublimate (1 to 10,000). As a rule, however, saline lotion (1.4 per cent.) 25 per cent. argyrol dropped in the eye every four hours will be found sufficient. In some cases the conjunctiva may be painted with 2 per cent. silver nitrate solution once in twenty-four hours.

HEMORRHAGE IN THE NEWBORN. Pierce⁹ continuing his review of recent literature on the newborn, devotes a chapter to hemorrhage. Nothing throws any light on the etiology of hemorrhagic disturbances in the newborn. Some progress has been made in the study of the pathology resulting from this condition more especially of *hemorrhage into the brain substance*. Treatment of this condition has resulted in a marked reduction in mortality from this cause. Consistently good results have been produced by the use of whole blood, citrated or not citrated, given under the skin repeatedly. Under the skin in mild cases or directly into the superior longitudinal sinus or, in the more severe cases, into some other convenient vein. Hedren¹⁰ found intracranial hemorrhage in about 9.28 of 700 infant cadavers. The hemorrhage was restricted to the meninges in nearly 84 per cent., and cerebral hemorrhage accompanied the meningeal hemorrhage in enough cases to bring the total to 90.7 per cent. Delivery had been spontaneous in 50 of 65 cases. He ascribes great causal importance to intra-uterine disturbances in circulation and compression of the head in the birth passage. In only 3 cases was inherited syphilis unmistakably present. Injury from birth trauma may resemble in every respect injury from certain external causes after birth, and may occur with rapid and easy spontaneous delivery. The onset is usually from the second to the fifth day, except in syphilitic cases, in which the onset is usually delayed from the seventh to the ninth day.

Balard¹¹ says concerning *gastro-intestinal hemorrhage of the newborn infant* that the hemorrhage is caused by infection or mechanical influence. The mechanical injury usually results from disturbances in the circulation, combined with difficult respiration, causing a sudden hypertension, especially in the abdominal organs. There is a reflex toward the umbilical veins, which explains the frequency of hemorrhage there. If the ligature is strong enough, this wave is thrown back on the abdominal organ causing intense passive congestion. As a result of severe infection, there is a change in the blood formula in the newborn with failure of the

⁹ American Journal of the Diseases of Children, September, 1919.

¹⁰ Ibid.

¹¹ Ibid.

blood to coagulate. The mechanical hemorrhages are early and isolated. The prognosis is benign. Infectious hemorrhages appear late, are multiple in location and incoercible, producing death of the infant.

In *intracranial hemorrhage* bleeding is usually subdural, but may be intraventricular. Diagnosis sometimes is difficult, refusal to nurse, pallor and facial edema are some of the earlier symptoms, and may soon be confirmed by the appearance of more classic signs. Appearances in some of these cases of hemorrhage of the newborn are deceptive. Frequently a baby will nearly bleed to death into the stomach or bowels before any blood is passed from the rectum. One ounce of blood in the newborn is equal to a quart lost by an adult. Shuman¹² reports a case of intracranial hemorrhage in a child of six weeks showing a clot of 1½ ounces weight in a child of six weeks. He believes the condition is more common than is generally supposed, quoting a percentage of two to thirteen of all postmortems of newborns as showing some degree of intracranial hemorrhage. The commonest lesion is subdural hemorrhage and may not manifest itself for days or even weeks after birth. Convulsions in these early weeks may be due to traumatic lesions of the brain. The tendency to hemorrhage, especially in syphilitic infants, is probably an important factor in many of these cases.

Discussing the cause of convulsions in infants less than three months of age, Francioni¹³ says that many of these infants develop normally afterward. Some convulsions are due to traumatic conditions or circulatory disturbance during birth. In others, symptoms of spasmophilia, syphilis, or tuberculosis become manifest later. Whatever the etiology, the types of convulsion were alike in all cases. It is manifest further that digestive disturbances may aid in bringing on convulsions in children who have a tendency in this direction. Owing to the stage of the development of the nervous system, the period before the third month is one of the greatest frequency of convulsions. Nuzum¹⁴ reports 3 cases of gastro-intestinal hemorrhage in the newborn caused by the presence of duodenal or gastric ulcer. The lesion as found at necropsy showed an ulcerated area with no thickening or ulceration at the edge, but a band of adhesions extending from the region of the ulcer in the duodenum to the gall-bladder and intestines. He declares that vomiting of blood or bloody stools in the newborn may be due to gastric or duodenal ulcer, rather than the melena neonatorum. The ulcers may occur in the child *in utero*, and are of thrombotic origin. Many instances of pyloric spasm, indigestion, and marasmus are due to these ulcers.

Writing on *asphyxia and hemorrhage* Manton¹⁵ says that 19 per cent. of all cephalic born babies enter the world more or less asphyxiated. If, in the asphyxiated child, we have the cyanosed face and upper thorax, the strongly pulsating cord, tonicity of muscles, with reflexes active, the prognosis is good; the condition being ephemeral. But if the child is pale and relaxed, resuscitation does not insure continuance of life. The most important and serious manifestations of neonatal asphyxia are those of cerebral pressure. When death results, necropsy reveals small

¹² American Journal of the Diseases of Children, September, 1919.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Ibid.

punctate hemorrhages into the meninges of the brain and cord. Some children survive this stage and the minute hemorrhages are absorbed without leaving a trace. On the other hand, cerebral pressure symptoms may mark a more extensive and serious involvement of the brain structures in most of these cases. The manifestations are the result of extensive intracranial hemorrhages.

CONGENITAL DEBILITY AND ATROPHY. Lesage and Kouriansky¹⁶ found this condition due to syphilis in from 25 to 35 per cent. of the cases. The Wassermann reaction was positive in this group. In about 50 per cent. there was no Wassermann reaction and an inherited taint from tuberculosis or physical exhaustion of the family, or acquired infection was responsible. The atrophy in these two groups is accompanied by transient muscular spasms, but alcoholism is the inherited causal factor with tenacious and persisting spastic atrophy, with negative Wassermann. When syphilis is a factor, the authors recommend the use of neosarsphenamin every eighth day, very slowly increasing the dose from 0.0025 to a maximum of 0.01 gm. After six or seven injections, they suspend it for two months then commence a new series. These small doses can be given immediately after birth, but should be discontinued in case of fever. They insist that this is the best treatment for latent syphilis in young infants. When there are visible lesions, the promptness with which they subside confirms the usefulness of the treatment. The vein of the elbow usually served, but occasionally the injection was made in the superior longitudinal sinus. On the day of the injection only sweetened boiled water is fed. Mercury has proved unsatisfactory as a treatment for young infants, in the experience of these writers. The same is true of neo-arsphenamin.

HABITUAL VOMITING. Marfan¹⁷ finds that when syphilis is a factor in habitual vomiting the infants seem to tolerate mercury lactate by the mouth better than other forms of the drug. In any event, the child must be fed in spite of his vomiting. Complete and protracted deprivation of food may aggravate the tendency to vomit. The most important thing to do is to feed the child, rather than to check the vomiting. If breast milk is impossible to procure, asses' milk is the second choice. Butter in milk causes the greatest trouble. These infants tolerate sugar well and the addition of 10 per cent. sugar to skim milk adds materially to its nourishing power. Kefer and buttermilk may answer, but generally they are too acid. He dilutes them, if he is obliged to make use of them, with one-third water and one-third (official) lime water. If the infant is three months old, Marfan adds a thin gruel with or without maltose; over six months a little thicker gruel with increasing proportions of milk. The stomach seems unable to expel these semi-fluid substances so easily. The infant tolerates small feedings at short intervals better, especially if the condition is serious. With a babe two months old, he begins with one to two teaspoonsful of ice-water every half hour. Half a day of this rests the stomach. He then feeds with a spoon breast milk or whatever food is to be used, not allowing the baby

¹⁶ Nourrisson, Paris, July, 1919.

¹⁷ Ibid.

to suck, as this arouses the vomiting reflex. All the food should be ice-cold and given a teaspoonful every fifteen minutes. If during six hours any of this is retained, he gives two and then three teaspoonfuls every half hour for six hours, the last quarter of the day he gives four to five teaspoonfuls and lets the child sleep unmolested for six or seven hours. The amounts are gradually increased, the intervals lengthened. Breast feeding is resumed according to the child's tolerance. The child may vomit occasionally while following this plan, but it receives sufficient food to increase in weight.

If the vomiting continues notwithstanding this treatment, Marfan feeds the child with a medicine dropper, giving the food by drops in the child's mouth every three or four minutes. A rather thick rice gruel may be used at one feeding if the child is over five months old. He relates other methods of varying the feedings and refers to Hess' method of duodenal feeding, and Fredet's success with rectal feeding. The underlying nervous excitability must not be overlooked, and the bottle should be held almost vertically to prevent swallowing air. After feeding, the infant's body should be held vertical for a few minutes to encourage the expulsion of any air which may have been swallowed. Hot enemas assist in overcoming vomiting, from 120 gm. at three months to 200 gm. at six months; twice a day at first, later once in two days. Bismuth may be useful by forming a protective coating for the stomach if given before feeding. One teaspoonful of a mixture of 2 gm. bismuth subnitrate in 45 c.c. each gum mixture and syrup of poppies. Or 0.25 gm. bismuth subnitrate may be added to the bottle. Hot compresses (131° F.) applied to the stomach and abdomen, renewed every hour for five or six hours, may be indicated in the graver cases. Twice a day the child may be put in a hot bath (101.4° F.) for ten minutes. Still another measure, if others fail, is a kind of gentle massage of the abdomen, twice a day for five minutes, the hand greased with camphorated oil. In the extreme cases sedatives are indicated, belladonna tincture doing better service than opiates, which do not give good results. He adds to the belladonna some bromide, which reinforces its action and some sodium bicarbonate as hyperacidity frequently is present and as the bicarbonate also has an anesthetic action. Lavage sometimes aids, but may, under certain conditions, bring on convulsions.

PARALYSIS OF NEWBORN. Arquellada¹⁸ classifies paralysis of the newborn from obstetrical injuries, into three groups: (1) Branchial or upper extremity paralysis; (2) lower limb paralysis, and (3) facial paralysis. In the first class of cases the paralysis usually disappears without treatment in two or three weeks, especially if the symptoms appear early, within the first few days of life. In cases in which the paralysis does not appear early, it takes longer in clearing up, sometimes two or three months. The prognosis depends upon the intensity of the case, the grade of the lesion, the kind of treatment employed, and the period at which it is instituted. In cases in which the paralysis fails to clear up spontaneously, the writer used electric applications, electrical massage, and mechanical

¹⁸ La Medicina Ibero, September 27, 1919.

therapy. Paralysis of the lower extremities receives similar treatment; nux vomica internally, gentle massage, manual at first, electric later on, and finally mechanicotherapy. Facial paralysis is the most common of these conditions. It is almost invariably caused by the pressure of the forceps blades. It is the most benign of all the forms with a good prognosis within a short period. Spontaneous clearing is the almost universal experience, the methods of treatment employed for the other forms of paralysis may be employed for it as well.

Thomas¹⁹ divides the treatment of these paralyses into two groups, operative and non-operative. The operation treatment consists in the operation upon joints to remove limitation of motion from contracted ligaments, and the transplantation of strong muscles to supplement the action of weak ones. The non-operative method consists of massage and educational gymnastics. Before the child is two months old, very gentle massage and irregular movements, such as moving the baby's hand and arm in various directions in imitation of voluntary movements, are employed.

CONGENITAL HEART DISEASE. Pierce,²⁰ in a careful review of this subject, gives a summary of the findings of other writers as well. He quotes Dunn as finding the essential diagnostic features of the various congenital cardiac lesions as follows: A case showing cyanosis with enlargement of cardiac dulness or palpable thrill, or both, is one of pulmonary stenosis. If the baby survives early infancy and lives into childhood, there is probably some other lesion associated with the pulmonary stenosis. A case showing a murmur and enlargement without cyanosis, is probably one of defective interventricular septum. If the murmur is transmitted into the neck, or if the humming top murmur is present, the lesion is probably combined with ductus arteriosus. A case showing a murmur without either cyanosis or enlargement, especially if the murmur is markedly transmitted into the vessels of the neck, or if it extends into diastole, it is probably one of open ductus arteriosus alone. If the murmur is of the humming top variety, extending throughout the cardiac cycle, one may make a diagnosis of the lesion with almost absolute certainty.

The prognosis does not vary with the forms, except in two instances; pulmonary stenosis alone, and open ductus arteriosus alone. In all other forms there is evidence that the patient may survive, and even live to adult life. The diagnosis in babies cyanotic from birth is grave. In cases which show the clinical picture of open ductus arteriosus alone, the prognosis is very good.

Cathartics and Laxatives. Fischer,²¹ of New York, considers that the habitual administration of laxatives and correctives to infants and children is a common but unfortunate practice on the part of mothers and nurses. Such drugs are used without rhyme or reason by those in charge of the infant. While the daily use of such agents may be necessary for a short time to stimulate the secretions and cleanse the intestinal

¹⁹ American Journal of the Diseases of Children, September, 1919.

²⁰ Ibid., October, 1919.

²¹ Archives of Pediatrics, July, 1919.

tract, to continue the practice for a period of months is unnecessary and harmful. In acute febrile manifestations or in toxic or septic conditions, where sluggish or pseudo-paralytic functions exist, laxatives are indicative and urgently required to eliminate stagnant residue and fermenting particles of food and their toxins which may be absorbed into the circulation. This is especially true in intestinal intoxication accompanied by fever, caused by excessive fat or protein feeding. Physicians should sound a note of warning to the laity that the pernicious habit of giving a daily laxative lessens the functional activity and weakens the intestinal mucosa. This in time will result in a total loss of the peristaltic waves, whereas modifying the diet and adapting it to the child would strengthen them. Peristalsis can be stimulated and modified in many ways other than by drugs. He believes excessive purgation weakens the glandular function and robs the glandular system of ferments and enzymes necessary for the proper assimilation of food and thus indirectly invites rickets and other conditions resulting from malnutrition. Rachitic atony simulates, and can be better removed by the use of cod-liver oil. The constipation accompanying cretinism should, of course, receive thyroid; $\frac{1}{2}$ grain of thyroid, three times a day, gradually increasing the dose until 1 grain is given three times a day has given good results.

Fischer also condemns the daily administration of warm soap and water enemata. It relaxes the muscles of the intestines and, if persisted in, produces atony, with a tendency to prolapse. A cold enemata (60° to 70° F.) has a stimulating and tonic effect, not more than one pint given at bedtime or before the second morning feeding. The benefits of the use of water is not sufficiently recognized. Fresh, cool water given between meals several times a day, aids in eliminating food residue. Water added to the food is not sufficient. The addition of bran to cereals, or the use of figs, raisins, whole wheat bread and the coarse cereals, such as oatmeal included in the diet of older children are most useful in stimulating the action of the intestines. The green vegetables rather than starchy ones, like potatoes, should be used. Morse,²² of Boston, agrees with Fischer in condemning the common use of cathartics, but asserts that cod-liver oil has no antiscorbutic properties. He also considers a dose of three-fourths of a grain of thyroid too large for children, not cretins. Hess,²³ of Chicago, reports experiments carried out at the Michael Reese Hospital with healthy babies to determine what quantities of different laxatives can be given without causing intestinal irritation. They found that 1 dram of magnesium sulphate or 1 dram of castor oil would cause microscopic blood in the stools. It is evident that these irritating cathartics can only do harm. Ramsey,²⁴ of St. Paul, states that aside from abnormalities, there is no such thing as constipation in newborn babies. Certainly the classical dose of castor oil on the third day is responsible for some of the subsequent trouble.

Education of Organic Functions. Prichard²⁵ declares it is a too common belief that the organic functions of the infant develop themselves on

²² Archives of Pediatrics, July, 1919.

²³ Medical Press and Circular, March 19, 1919.

²⁴ Ibid.

²⁵ Ibid.

correct lines without guidance. In the majority of cases they do, yet they are largely under the control of human intelligence, unwisely directed they give unfortunate results, which may be permanent. This is especially true of feeding habits. The neuromuscular mechanism by means of which food is swallowed, churned in the stomach and conveyed through the entire length of the intestines, depends for its proper working on accurate coördination of a vast number of involuntary muscles, some of which are specialized to form regular sphincters, while others carry on peristaltic functions. Overaction, perverted action or incoördinated action of these mechanisms is likely to result if the wrong sort of stimulus is provided in the first instance. It is important to set the mechanism in motion in the right way in the beginning of life. An infant who in the first days of life swallows its food in a perfectly coördinated manner is unlikely to develop any symptoms of dysphagia afterward. But if, because of feeding food unsuitable either in quantity or quality, the infant acquires a faulty habit of swallowing, the perverted function may remain, whatever may be done to correct it. A form of this perverted function is called "rumination" which is a spasmodic closure of the cardiac sphincter leading to the retention of food in a dilated esophagus and the subsequent regurgitation of food which has never reached the stomach. The motor mechanism of the stomach is much more likely to be developed wrongly than those of the esophagus. Under normal conditions, breast feeding conduces to develop normal evolution of gastric function, colostrum being especially adapted, by reason of its small quantity and stimulating qualities, to promote the required motor response in the stomach still causing no violent motor response of the pyloric sphincter or of the stomach. It gradually changes in a few days into ordinary milk, thus calling the normal functions of the stomach into play. Cases of pyloric spasm constantly arise in young infants because unduly large amounts of undiluted cow's milk were given during the first days of life. So-called wind in the stomach in infants is usually caused by dysperistalsis or spasm of some section of the muscles of the intestine, usually of the transverse colon. It is usually due to faulty education or overstimulation by excess of food or by indigestible food. The spasm becomes habitual and tends to occur every day at the same time. Constipation or looseness of the bowels is also largely a matter of education. Interference with the functions of the rectum and anus by the favorite dose of castor oil often establishes faulty and incoördinated reactions, by clearing the bowel at one fell swoop of the beneficent meconium which is intended to educate the rectum in the functions of defecation.

Transfusion of Blood in Infants and Children. In a discussion upon this subject before the recent meeting of the American Medical Association Koplik,²⁸ of New York, asserts that transfusion in the newborn is applicable, (1) in cases of uncontrollable hemorrhage from wounds, umbilicus, or scalp hematoma; (2) forms of frank melena with hemorrhage from the intestine and subacute or gastric hemorrhages; (3) concealed melena

²⁸ Journal of the American Medical Association, July 19, 1919.

in which the outward subjective signs of hemorrhage are slight, such as occasional ecchymosis on the surface, but in which the evidence of internal hemorrhage is great; and (4) cases of severe and continued hemorrhage in the newborn from surgical wounds, such as circumcision. We have two methods, and the time is scarcely ripe to choose between them. They are the Unger and syringe method, and the so-called citrate method of Lewisohn. Koplik has found both methods applicable. Cases have come under his observation in which the subcutaneous injection of serum absolutely failed to control hemorrhage, or even the subcutaneous injection of whole blood. In these cases a single definite transfusion succeeded in combating the symptoms which the other system failed to control. Elevation of temperature is not a contra-indication to transfusion, nor is congenital syphilis. Transfusion has proved uniformly successful in combating hemorrhages in late infancy and older children, even when large quantities of blood had been lost. In a case of pernicious anemia, a rare condition in children, two transfusions of 140 and 120 c.c. of citrated blood initiated improvement which went on to complete recovery. Transfusion is useful in acute diseases with a tendency to hemorrhage. Acute and chronic leukemias are not benefited permanently by transfusion. Purpuric conditions are not improved. Henoch's purpura is especially rebellious to this treatment. Transfusion was without success in several patients who had a low temperature with infectious endocarditis. One form of streptococcus invasion may improve if transfused intensively and repeatedly; this is the form of blood sepsis which does not affect the heart itself. In certain septic infections it is advisable to remove blood to make way for the introduction of new blood. Koplik employed blood transfusion in a case of influenzal nephritis when the patient was sinking fast and the urine showed the presence of blood. Not only was there cessation of bleeding, but complete recovery from the nephritis. On the other hand, many patients with the same affection were transfused unsuccessfully, perhaps because the physician waited too long. As the indiscriminate performance of transfusion will bring the process into disrepute, there should be a definite idea or indication for its use.

Abt,²⁷ of Chicago, calls attention to the fact that temperature observations on the newborn have not only scientific interest but a clinical bearing as well. It is of fundamental importance to properly interpret the temperature fluctuations in infants. The peculiar levels and temperature curves in young infants should be recognized. Changes in temperature in infants do not of necessity have the same meaning that they have in adults. Sudden high temperatures in newborn infants occur frequently. Abt has followed many children through infancy and childhood who thrive and seem to be in perfect health, yet constantly show a temperature of 99° F., 99.5° F. and even 100.5° F.

Epistaxis. An instructive case of recurring epistaxis in a child, aged six years, is reported by Bonanba.²⁸ The condition persisted for four or five years and was complicated by a purpuric eruption, with vomiting

²⁷ Illinois Medical Journal, July, 1919.

²⁸ Archives Latino-Americanos de Pediatria, March, 1919.

of blood and bleeding from the gums until the anemia was intense. The red cells numbered 950,000; the hemoglobin, 15 per cent. As a last resort, the nasopharynx was cauterized. The hemorrhagic tendency seemed to immediately subside. The blood regenerated and the child was in normal condition after nine months, when the report was made. The improvement in the condition of the blood may explain the cessation of the hemorrhages in other places.

Chemical Examination of the Blood in Infants. Chapin,²⁹ of New York, reports findings in the analyses of the blood of 137 infants and children; 38 of whom were suffering from nephritis and 6 from diabetes. The sugar, urea, urea-nitrogen, creatinin, carbon dioxide combining power and phthalein output were estimated. The cases of nephritis included chronic nephritis, acute nephritis, and chronic nephritis following acute infections. The normal figures for sugar, urea, urea-nitrogen, and creatinin in the blood of children differ but little from the normal figures in adults. The blood of children shows a better phthalein output. Nephritis in children does not result in retention as quickly as in adults. Creatinin occurs rarely, though it was found in two out of four cases dying of chronic intestinal nephritis. The blood-urea is an especially helpful diagnostic test in nephritis of children. The results of the phthalein test harmonize well with the clinical findings and the blood urea. The carbon dioxide combining power of the blood is a very reliable manner of determining the severity of the acidosis. In a series of diabetic cases the changes in the blood antedate all other symptoms. One frequently finds a hyperglycemia before a glycosuria can be detected, or when there is merely a trace of sugar in the urine. The findings in diabetics do not differ from those found in adults.

Early Mortality. Holt and Babbitt³⁰ make a report upon mortality in young infants. They have as a basis for their study a carefully kept record of 10,000 births at Sloane Hospital for Women in New York City. Their findings are as follows: Deaths during the first fourteen days, were 3 per cent. of the living births. Approximately 48 per cent. of the total deaths and 66 per cent. of deaths due to prematurity occurred on the first day. Congenital weakness and atelectasis together made up 58 per cent. of the total deaths. Accidents of labor, hemorrhage, sepsis and asphyxia caused 20 per cent. of the deaths; syphilis, 4 per cent.; and various malformations and congenital diseases, 4 per cent. The only important disease developing after birth was pneumonia. Stillbirths are one and a half times as great as deaths from all causes during the first two weeks. Aside from syphilis, the causes of stillbirth in no way differ from those producing death during the first days of life. Care of the mother during pregnancy would reduce the number of deaths from weakness, and good obstetrics to reduce deaths connected with parturition might prove effective in reducing this large mortality of the newborn.

Bosc³¹ states that the mortality among infants in the public hospital

²⁹ Archives of Pediatrics, July, 1919.

³⁰ American Journal of Diseases of Children, July, 1919.

³¹ Bulletin de l'Académie de Médecine, November 4, 1919.

at Tours had always been high, reaching even the great figure of 50 per cent. notwithstanding that the healthier children were boarded out in the country. In 1916, a new system was instituted. Every woman delivered in the maternity was compelled to remain in the hospital and nurse her child for three months. If they would not promise to do this they were not received. During this period, her board and lodging was free and she received 1.25 francs a day. Since this new plan went into effect, 32 married women and 239 unmarried have been detained in this way. The mortality has dropped from 50 per cent. to 2.7 per cent. The mother who has nursed her child for a month and seen its first smile, changes her mind about abandoning it, as had been her intention, and takes the child with her when she leaves. During these three years not one child has been abandoned by its mother. Some keep the child with them, earning the nursing premium of 30 francs. Some children are placed among friends, but the mother supervises their care.

Routh³² reports that in England and Wales about 150 potential children die for every thousand live births. In 1917 there were 25,044 newborn children, but nearly half of these babies died within four weeks of birth, mainly from causes connected with childbirth. Illegitimate offspring, both before and after birth, died at nearly twice that rate, for want of care which the State should provide. The most powerful causes for this death-rate among little babies are two important conditions, parental syphilis and alcoholism. The only way to combat these evils is through the weight of public opinion. The deaths in England and Wales for the first time exceeded the births in the six months ending March 31, 1919.

According to Hanna,³³ the day of birth records the highest death-rate of all days. It has been established that 5 per cent. of all children are stillborn or die during labor and 1 per cent. die soon after birth as the result of injuries received then. In the United States 75,000 children die annually during delivery. A large number of these die from asphyxia and injuries received during birth. Other causes are syphilis, alcoholism, and congenital defects. Seventeen per cent. of the inmates of feeble-minded institutions of Indiana give a history of difficult births, and 4 per cent. of forceps operation.

Fat in the Stools of Breast-fed Infants. Reliable figures on the composition of the stools of breast-fed infants are particularly scanty. For this reason and because of the great importance attached to all information concerning the results of breast feeding, it has seemed fitting to begin a general study of the fat metabolism of infants and young children, with the examination of a considerable number of stools of breast-fed infants. Holt, Courtney, and Fales,³⁴ of New York, have made observations with a view of answering the following questions: (1) What is normally the percentage of total fat and what is the distribution of fat as soap, free fatty acids and neutral fat in the stools of healthy breast-fed infants? (2) What is the difference in fat content and distribution of fat between normal and abnormal stools? (3) Does the amount and

³² New York Medical Journal, November 22, 1919.

³³ American Journal of Diseases of Children, September, 1919

³⁴ Ibid., April, 1919.

distribution of fat in the stools of the healthy breast-fed infants vary with the percentage of fat in the milk and with the amount of fat intake? The material examined consisted of forty-eight collections of feces from thirty-four different infants from ten days to ten months of age.

The authors draw the following conclusions: (1) The fat of the stools of normal breast-fed infants, averaged 34.5 per cent. of the dried weight and frequently was as high as 50 per cent. (2) The soap fat in the breast stools predominated over the other forms of fat, averaging 57.8 per cent. of the total fat as determined on the dry stool. The average stool of the normal breast-fed infant showed a soap fat of 43.1 per cent. of the total fat as determined on the dry stool, which would correspond to over one-third of the total fat of the fresh stool. (3) The neutral fat in the best stools averaged 15.9 per cent. of the total fat; in the average stool, the neutral fat was 20.2 per cent. of the total fat. The amount of neutral fat is not affected by the drying process. (4) No constant relation was shown between the percentage of fat in the mother's milk and its distribution in the stool. (5) With a higher total intake of fat, the fat percentage and the soap fat in the stool were somewhat increased. (6) The range of fat absorption from 90.3 per cent. to 99.2 per cent. of the intake was found in healthy breast-fed infants.

Fat in Stools of Artificially-fed Infants. An extended study of fat metabolism of infants and young children is reported by Holt, Courtney and Fales.³⁵ The questions considered were as follows: (1) What is the variation in the percentage of total fat and the distribution of fat in the stools of infants fed on cow's milk, under different conditions of digestion? (2) How is the distribution of fat and the percentage of fat in the stool affected by the fat intake? (3) What percentage of fat is retained under different conditions of digestion and how is the retention affected by the amount of fat intake? The fat retention of infants taking cow's milk averages 88.6 per cent. of the intake; of those taking breast milk 95.8 per cent. of the intake. The daily loss of fat by infants taking cow's milk is over twice as great as those taking breast milk, even though the actual amount of intake is somewhat less.

The material presented in this article comprises the results of analysis of 128 stools of 77 infants ranging from two to ten months, fed on modified cow's milk. The average fat percentage of the dried weight in normal stools was 36.2. The hard constipated stools showed no variation from this figure. In the stools not quite normal in appearance, the average fat percentage was slightly lower. In severe diarrhea the fat percentage of dried weight was much higher, reaching an average of 40.7 per cent. The soap percentage was high in both normal and constipated stools, averaging respectively, 72.8 and 73.8. As the stools became less normal in appearance, the soap rapidly disappeared and averaged in the loose stools only 30.6 per cent. of the total fat, in the diarrheal stools 12.4, and in those of severe diarrhea only 8.8 per cent. of the total fat. The neutral fat was less than 10 per cent. in both normal and constipated stools. It increased as the soap diminished and in

³⁵ American Journal of the Diseases of Children, June, 1919.

diarrheal stools made up about 60 per cent. of the total fat in the stool. The free fatty acids constituted about 17 per cent. of the total fat of normal and constipated stools; in diarrheal stools, over 30 per cent. No definite relation was found between the daily fat intake and the percentage of fat or the distribution of fat in the stool, except when the intake was abnormally low.

Cholesterol Metabolism of Infants. Blakfan and Gamble,³⁶ of Baltimore, state that cholesterol, an important constituent of tissue cells, may also bear important relations to physiological processes. Cholesterol, or substances very nearly identical, are present in all natural foods. The difficulty of finding a food free from cholesterol has prevented satisfactory proof by animal experimentation as to whether it is synthesized within the body. If it is not, an adequate amount must be provided in the food to maintain the chemical structure of the tissue cells and provide for growth. In the food of an infant the amount of cholesterol is roughly proportional to the amount of fat present. This substance has never been found in the stools of infants. Apparently, none of the cholesterol excreted by an infant undergoes reduction in the intestinal tract. This makes it possible to study the cholesterol balance in infants. The authors assume that the finding of a consistently negative cholesterol balance in normal or gaining infants would indicate cholesterol synthesis. They have found it necessary to modify extensively an existing colorimetric method for measuring cholesterol in order to determine with accuracy the cholesterol-content of milk and stools. The balance of several infants has been determined. With one exception, a large negative balance was found. The authors intend to obtain further data on this point. The results obtained suggest that cholesterol is synthesized within the body. The relation of cholesterol to maintenance and growth apparently do not depend on the amount of cholesterol in the food.

Proteolytic Intestinal Flora. Porter,³⁷ of San Francisco, says that investigation of many stools evacuated by healthy infants and children shows that there is a standard flora in the intestines of healthy babies and children. Examination of the stool of children suffering from different types of intestinal disorders demonstrate that in such cases the flora in the intestines vary from the normal. The normal stool shows a flora composed almost equally of aciduric and protein-splitting organisms. In the nutritional disorders studied, the flora all showed a predominance of proteolytic types of bacteria. These children all showed clinical disturbances manifested by symptoms of toxemia. They all responded to limitation of meat, milk and white of egg, together with a diet high in lactose and dextrins, by a swing of the intestinal flora to a predominance of preventive forms. An amelioration of the clinical symptoms always accompanied this change in diet. On a rational diet, well-being has been maintained and the stools have maintained a floral balance approaching the normal. The author does not claim to have established an etiological relationship between alimentary intoxications and the

³⁶ Archives of Pediatrics, June, 1919.

³⁷ Journal of the American Medical Association, July 19, 1919.

flora of the intestines, but his work points to the possibility of such a relationship, and to the need of further and more intensive investigation.

Koplik,³⁸ of New York, without criticizing the milk which Porter used, points out that a great deal depends on how protein milk is made. Unless it is properly made, it rather hurts the baby and may cause bloody diarrhea. Milk may be stored too long before being prepared, and here we are in the hands of the dealer. Porter used lemonade, I eliminate all sour foods, yet we have each obtained excellent results. Fleichner,³⁹ of San Francisco, says any method is acceptable which offers some criterion upon which to base the feeding of the type of infant which Porter describes. It is better to have a method based on a logical basis, than to proceed in an empirical way. Where butyric acid fermentation is concerned, it is better to leave the fat out of the diet, and Porter seems to have followed this method. If the etiologic factor is the proteolytic anaërobes, then to get at the root of the evil, the protein element must be considered and both fats and proteins must be reduced or eliminated for a time. Porter says that any one must be struck by the fact that we cannot feed high fats when the protein is low, as shown by the soapy stools that result when we follow this method. That is the reason Finkelstein resorted to albumen milk.

A study of the intestinal contents of the newborn is reported by Hymanson and Kahn,⁴⁰ of New York. These authors made very elaborate and scientific examinations to determine the constituents of meconium, which are reported in a series of tables. The results obtained seem to more or less contradict the findings of other earlier similar investigations, of which tables are also given. The whole question seems to be left open for further work.

The Measure of Nutrition and Development of Children. This subject has been constantly receiving more attention and has occupied a large place in the thought of the profession as well as the welfare worker. A large amount of work has been done to correct malnutrition. Retan,⁴¹ of Syracuse, shows charts recording careful observations along these lines. The author asserts that malnutrition should be considered a disease; its cause should be determined and remedied. The principal causes of malnutrition may be classified as follows: Physical defects; adenoids, hypertrophied tonsils, decayed teeth, eye strain; habits; concerning food, tea, coffee and alcohol, insufficient food, candy between meals; lack of sufficient rest; hygienic; sleeping in congested, unventilated rooms; disease. These causes of malnutrition suggest their cure. Each undernourished child should receive a thorough physical examination. Any physical defect should be removed. Tonsils and adenoids or faulty diet cause the great majority of cases of malnutrition.

Diet in Digestive Diseases. Preventive medicine is the medicine of the future and is already making great progress. Everybody recognizes that it is better to prevent than to cure disease. The adage to that effect is one of the most ancient of familiar sayings. The majority of medical

³⁸ Journal of the American Medical Association, July 19, 1919.

³⁹ Ibid.

⁴⁰ American Journal of the Diseases of Children, February, 1919.

⁴¹ New York State Journal of Medicine, November, 1919.

men realize that it is easier to prevent than to cure disease. Diet is one of the most important factors in producing health or its reverse. Moreover, it is evident that childhood is the time to begin, for in childhood the constitution should be built up so that the vital resistance to disease is developed. The July number of the *Practitioner*, says an editorial article,⁴² considers the question of diet from the viewpoint of health, and the August issue of the same journal, from that of disease. In the latter number, Pritchard⁴³ deals with the connection between food and disease in infants. He asserts that resistance to infective disease is a function of metabolism and mainly of nitrogenous metabolism. A one-sided carbohydrate diet develops habits of metabolism which are ill-suited to combat bacteria or to neutralize their products. Therefore, sugar-fed children are peculiarly susceptible to disease and show feeble resistance. "As the twig is bent the tree will incline" and the child must form the habit of eating that kind of food which will render it immune to the attacks of disease.

There is another favorite custom in feeding children which Pritchard attacks; that is overfeeding. While overfeeding is a fault on the right side, excess of food is harmful. Deficiency diseases are much more evident at the present time, and rightly so, but at the same time it should not be forgotten that "excess disease" is still more frequent. These include not only those diseases which are associated with derangements of digestion but also those which are connected with disturbances of internal metabolism. The great majority of the dietetic diseases of infants are due to excess in quantity irrespective of their qualitative makeup. The injuries are mostly due to intestinal toxemia or to incomplete combustion by the processes of internal metabolism. The organism bristles with protective mechanism to prevent serious effects of overfeeding but calling into play even the least harmful of these processes must be considered pathological. Pritchard does not believe, from his experience, that vegetable fats can be substituted entirely for animal fats in the infant's food without impairment of nutrition. Neither does he believe that the deprivation of fat-soluble vitamins is an important element in causing rickets, which he has seen occurring in infants overfed with cream, and, in several, cod-liver oil has been given in addition. Pritchard makes three statements: carbohydrate food is not indicated as the main diet of infants, because it predisposes to infective disease; excess of diet is worse, or at least as bad, for infants as a deficiency of food in some of the indispensable nutritive properties; and lastly, the absence or lack of the fat-soluble vitamins is not responsible to any extent for the production of rickets. This latter statement will arouse special interest here in America.

Nobecourt⁴⁴ asserts that the deprivations of war have thrown much light on dietetic questions especially so far as children are concerned. In laying out a plan for feeding an infant, he considers it most unfortunate that the requirements for growth should be so frequently overlooked.

⁴² New York Journal of Medicine, September 27, 1919.

⁴³ Practitioner, August, 1919.

⁴⁴ Presse Médicale, Paris, November 5, 1919.

Pediatric literature for years past has contained a large percentage of articles on artificial feeding of infants. There was no question but that breast feeding, or the natural food of infants, is the best by far, but the practical question of substitute feeding was ever before the profession. Finally, it has become so generally accepted that modified cow's milk is the most reliable second choice and the formulas have at last been so well worked out that this year there has been practically nothing written on the subject. Careful investigations of the stools of infants in health and various abnormal conditions have been instituted for the purpose of determining what variations of food will control or counteract various digestive disturbances. Theoretically, this subject is easy, assuming that we know the chemical composition of food and its action in the gastro-intestinal canal. However, we do not understand all the physiological processes connected with digestion, and there is always the factor of individual idiosyncrasies.

Griffith,⁴⁶ of Philadelphia, has written a very well considered and extensive article on diet in digestive diseases in infancy. For acute gastric indigestion, no food whatever, he finds, should be given for twenty-four hours, with the exception of barley water, which is no better than plain water but comforts the mother. If the vomiting is very severe it is better to withhold water itself, giving what liquid may be necessary by rectum. After the attack has subsided, barley water may be resumed, or small quantities of albumen water or fat-free broth may be given frequently. Return to the ordinary diet may be made by way of diluted skimmed milk. Fat usually is not tolerated in this condition. He points out that there should be no haste to return to the full diet, because, if the child was perfectly well before the attack, it can stand a certain amount of starvation. Too much haste may bring on more serious trouble. The causes of this condition may be mechanical or chemical; too much food may have been given, or it may have been unfit chemically. Changes may have taken place in the milk before it was given; the mixture may have been entirely wrong. In any event the process is an acute one, largely local, having few constitutional symptoms except fever. The chief symptoms are vomiting, abdominal pain, and, later, diarrhea.

ACUTE DIARRHEA. The causes are much the same as gastric indigestion; it is often a sequel to that condition. It often gives more trouble because it is more prolonged. Should diarrhea occur, an inspection of the stools may aid in determining a proper diet. If the stools contain curdy masses in greenish or yellowish watery fluid, with a little mucus, we may infer that the fat is not being digested. If they are sour-smelling and fermented, excoriating the buttocks, there is an excess of carbohydrate which is undergoing acid fermentation. If decidedly offensive in odor, protein decomposition is going on. However, when albumen water is being administered, the stools are almost always offensive in odor. The same dietetic measure should be employed as in acute gastric indigestion, having, however, the character of the stools in view. It is

⁴⁶ New York Medical Journal, September 27, 1919.

even more important to be slow in getting back to the milk diet. Milk, while the best food for infants, may become one of the most dangerous when disturbances of the gastro-enteric tract are present.

ACUTE GASTRO-ENTERIC INTOXICATION is much more severe than the preceding disorders for we have the element of decomposition of the tissues due to toxemia. The local symptoms are important, but the constitutional ones still more so. The great desideratum in the treatment, according to Griffith, is not to allow it to occur. Weaning in summer-time should be avoided if at all possible. If acute gastric indigestion or acute diarrhea develops, treatment of the attack must be prompt and thorough, and starvation must be continued long enough to ensure that gastric intoxication does not occur as a sequel. Food should be protected against bacterial contamination. Milk, even the best, should be pasteurized at home during hot weather; the quantity and strength of the food should be reduced, even though the child does not gain in weight. The dietetic treatment of this condition is very similar to that described for the preceding two conditions, and the return to ordinary food must be very slow, but the infant should receive an abundance of water to make good the losses through the diarrhea and to prevent acidosis. When there is little appetite and insufficient food is taken, cereal gruels serve a good purpose. Griffith again emphasizes that the return to milk should be very slow and cautious.

ACUTE ILEOCOLITIS AS AN INFLAMMATORY DISEASE. This must be borne in mind lest the continuance of the fever lead us to do without food too long on the ground that toxemia still persists. The condition is not toxic but inflammatory. Consequently, no starvation period is required. Dietetic management is, however, of the greatest importance. Milk should be avoided at first and possibly throughout the entire attack. In place of milk, broths should be used. Strained clear broth gives no nourishment whatever, To make it of value it must be thickened with some starchy substance and often allowed to contain the meat fiber which has been well broken up by prolonged cooking. Strong gruels, sometimes dextrinized, may be used. Albumen water may be used to supply the protein needed, and scraped beef may also be of service. Finally, one may return to milk by the use of whey, skimmed milk, or peptonized skimmed milk. The food is best administered in small amounts at short intervals.

CHRONIC GASTRIC INDIGESTION. Chronic gastric indigestion causes troublesome vomiting in infancy; it is usually a sequel to one or more attacks of acute gastric indigestion from which recovery has not been satisfactory. An unsuitable milk mixture will often cause it, frequently too much fat. In other cases, the diet contains substances other than milk that are most unsuitable for the child. Rickets, tuberculosis and other constitutional diseases may cause it. The most important symptom is persistent repeated vomiting which interferes with the retention of sufficient food for the infant's requirements. The baby may be suffering from pyloric stenosis; the vomiting may be of a nervous nature; or a habit vomiting. The food may be right in composition and given in too large quantities. All these matters being eliminated, we

must study the character of the food. Probably it is too rich in fats, then in sugar. The protein is usually borne better. The determination must be experimental. First, the fat should be reduced, buttermilk being very serviceable. Use buttermilk fortified by the addition of wheat flour and sugar, in quite considerable amount, raising the carbohydrate to 10 or 11 per cent. The vomiting continuing, reduce the sugar. Griffith has sometimes obtained surprisingly good results from this. Casein milk serves in other cases. The presence of a large proportion of carbohydrate certainly aids in the digestion of proteids, and probably also the fat.

CHRONIC INTESTINAL INDIGESTION. This is a very common and exceedingly troublesome disease, whether associated with chronic gastric indigestion or occurring alone. It may be caused by poor hygienic surroundings, congenital constitutional debility, or it may follow acute ileocolitis; but continued use of an unsuitable diet is the most common cause by far. The symptoms vary with the case; in some, constant diarrhea with watery, greenish, and sometimes curdy stools, a large amount of mucus indicates the presence of a chronic ileocolitis of mild grade. If there is but a small amount, the disturbance is largely functional. In other cases the stools are diarrheal only at times, but for the most part are of the soap stool character. Here it is apparent that the fats are not digesting. Vomiting may, or may not, occur. The appetite is sometimes good, sometimes poor. The chief symptom is steadily increasing malnutrition. The impairment of health seems out of proportion to the visible gastro-intestinal manifestations. When it is so difficult to come to a conclusion regarding the exact cause of the disturbance, the dietetic treatment is difficult indeed. A careful dietetic history of the infant must be obtained from birth. This may show what fault in the food originally caused the disturbance or has maintained it. The degree of digestion occurring may be obtained from the stools. Then we can prescribe a diet. It is very much easier to prevent chronic intestinal indigestion than it is to cure it and the most important matter is to avoid weaning, if possible. Very many mistakes are made in this connection. An infant during the first weeks of life does not seem to digest its food properly and the physician is too often disposed to advise weaning with, what seems to Griffith, too much haste. A little longer continuance with breast feeding may develop a better digestion on the part of the child and a more normal secretion of milk on the mother's part. In cases of insufficient milk, it is better to use supplementary feedings, since breast milk contains elements not found in cow's milk. For babies artificially fed often the best procedure is to secure a wet nurse. That being impossible we have to begin with a partial starvation, using a thin cereal decoction or arrow root water. The nature of the stools must determine the diet. Casein milk without the addition of sugar is often very serviceable when there is indigestion of sugar as well as fat; the large protein element being, as a rule, well tolerated.

Griffith warns that all these substitutes for the ordinary diet are substitutes only and in most cases it is wise to return as soon as convenient to a regular milk mixture suitable to the age of the child. There

should, however, be no undue hurry about this and it is perfectly possible to feed a child on buttermilk or malt soup for months at a time. Indeed, if the child is thriving on it, there is really no reason for a change until the age of one year is reached, when the ordinary diet for that age may be instituted. All this must be determined by the individual case.

Food dilution and frequency of feeding are important. Some do better on a more concentrated food, others on a diluted, although the total number of calories may be the same. Only trial can show which is better for any one child. The mutual influence which the various food elements exercise upon each other is of importance. The protein and fat may be made more digestible if a high carbonate content is present. The fat is sometimes better tolerated if the whey, with its salts, is reduced. Avoid proprietary foods as a rule. They contain nothing which cannot be supplied at home and are expensive. The object of this article was to suggest some dietetic measures to be followed. No reference has been made to other measures, such as drugs, etc., not because they are not useful, but they are outside the purpose of Griffith's present article.

WATER DIET. Marfan⁴⁶ gives Luton, of Rheims, in 1874, the credit for the first use of a water diet in intestinal disease. Restriction to water rests and soothes the digestive apparatus, and seems to modify the intestinal flora, while replacing the fluid lost by the diarrhea and washing out of the system by flooding the kidneys and the sweat glands. It also tends to reduce the heat. The water should be plain and pure. It is wise to boil it. The same amount should be given as the quantity of food which the child would ordinarily take. Unless this amount is taken, we defeat our purpose. A child can go from six to ten hours without taking anything, if it refuses water. The best way to give it is a teaspoonful at a time. Two teaspoonfuls every half hour for the first two hours; four teaspoonfuls every half hour for two hours; then six every half hour for two hours; eight every hour; ten every hour and a half. The last third of the first twenty-four hours a nursing bottle of 100 gm. every two hours. This water diet should not be kept up over three days. A breast-fed baby rarely needs to be kept on a water diet more than twelve hours. The ordinary food must be resumed gradually, according as the condition of the child may indicate.

Benedict and Talbot⁴⁷ have for eight years been making a careful study at the Nutrition Laboratory of the Carnegie Institute at Washington, on the energy metabolism of normal infants and children from birth to puberty. A detailed report will be given later in a publication of Carnegie Institute. The younger children studied were normal breast-fed infants studied at the Boston Directory for Wet Nurses. The older subjects were selected from the New England Home for Little Wanderers, every effort being made to secure normal individuals in every instance. The report consists for the most part of charts. During the first year of life there is no difference in the metabolism of boys and girls, then boys have a somewhat higher metabolism than girls of the same

⁴⁶ *Le Nourisson*, Paris, September, 1919.

⁴⁷ *American Journal of the Diseases of Children*, October, 1919.

weight, until they reach 34 kg. of body weight, it again becomes the same. Later it becomes somewhat higher in the girls. Muscular activity increases the metabolism. In newborn infants kicking and crying may increase the metabolism by 200 per cent. The metabolism is increased about 25 per cent. by activity over what simple existence would demand. The greatest rate of growth is during the first six months of life when the infant doubles its weight; during the second six months the gain in weight is approximately the same but shows only 50 per cent. increase against the 100 per cent. gain of the first six months.

Weaning. Graham,⁴⁸ of Philadelphia, advises to begin weaning a baby with a cow's milk mixture considerably weaker than would be given a healthy baby of the same age which had been brought up on the bottle. A fair average would be to start with a formula of about half the strength that would ordinarily be given to a healthy infant of the age of the baby to be weaned. If this is digested, it can be cautiously increased. It is wiser, as a rule, not to wean the baby during warm weather, but if the child is removed to a cool climate that consideration does not need to be taken into account. Always, if possible, wean slowly, giving one bottle a day at first. If this agrees after three days a second bottle feeding may be given. In this way the breast feeding is gradually discontinued. A baby should be weaned if the mother has any disease which can be transmitted to the babe, such as typhoid or tuberculosis, or acute pneumonia, if the mother becomes pregnant. Weaning depends in most cases on the ability of the mother to furnish sufficient food. If the infant does not receive sufficient nutrition, one or two bottle feedings may be given. Graham gives one bottle a day to a nine-months-old baby even if it is healthy and thriving.

Milk. The problem of supplying an abundant and perfectly safe milk at a price within the purchasing power of everybody, still remains unsolved. Several interests represented by many different people are working out a solution of this hard question, attacking it on various sides. Kitchen,⁴⁹ a physician and also the owner of a large dairy farm, where he has studied milk production from a scientific, as well as a commercial, standpoint, has at last brought together several individual discoveries, and a number of hitherto well known facts but dissociated, in such practical coöperation as to secure the desired result. At least he believes that he has found the answer, correct scientifically and practical commercially. He believes he has found how to secure an entirely safe, clean and wholesome milk supply for the masses, at prices which the masses can afford or will be willing to pay.

The requirements were as follows: (1) An efficient, final container that would prevent reinfections of the milk in the container, both during and after the bottling. (2) A milk supply that would give a milk at least the least the equal of "certified milk" in cleanness and freshness, at a price the general public can afford. (3) Improved methods for handling the milk by dealers and others; reliance alone on cleanness of production and pasteurization not being adequate to assure safe and

⁴⁸ Pennsylvania Medical Journal, June, 1919.

⁴⁹ Pan-American Dairy Co., East Orange, N. J., 1919.

wholesome milk. (4) The education of the public to be willing to pay a slightly higher price for protection from possible or probable danger. (5) Education of capitalists to induce them to put more money into improved equipment, enabling dealers to render an adequate service to the public. (6) Securing the funds needed for carrying out this educational campaign.

The clean milk campaign that has been waged for twenty years or more, has accomplished about all that can be expected it would, but it must be continuously pushed lest we lose ground. Cleanliness is one of the first requisites for the production of good milk. Good milk must be clean, it should be fresh and it should be free from living disease-producing germs. It must be wholesome. It should taste good. It should be free from accumulations, the products of fermentations that have occurred either within or outside the cow's body. Such products are at least unwholesome and may be dangerous, especially to infants. They should be eliminated from the milk before it is bottled and consumed by human beings. It is practically possible to eliminate them by a more thorough process of aëration than is generally practiced. Milk should be free from decomposition products as well as the germs producing them.

Freshness is an important property of milk. Possibly because the enzymes which originate in the cow may be beneficial in promoting digestive activity. This is not yet proved. Fresh milk has some property which prevents for some hours, at least, the growth of germs in it. If milk is consumed while really fresh or in a condition that is equivalent to freshness, the time-of-holding element is eliminated. Kitchen asserts that to secure proper refrigerative influence, milk should be reduced in temperature to 32° F. very shortly after production, before it loses its aseptic power. This can be done by having a cooling tank sufficiently large.

Health officials in various communities should all work together to prevent the dumping of bad milk rejected in one place, upon another community. All health officials should take a bacterial count; should order dealers to deeply refrigerate their product; demand thorough aëration of milk; should urge the financially stronger dealers to pasteurize the milk after it has been placed in its final containers; should insist on adequate protecting stoppers for milk bottles; should warn consumers against risks in using milk of uncertain sanitary character; should publicly recommend dealers to the public who furnish really fresh milk; should publish reports as to the condition of every dealer's milk; should encourage capital to invest in aid of the "good milk" movement. If health authorities have not the power to do this, it should be given by legislature. Some might doubt the wisdom of putting so much power in the hands of health officials.

Intestinal Parasites. An editorial article in the *Journal of the American Medical Association*, October 25, 1919, says that so long as an adequate inspection of the children in a group of public institutions can show an incidence of intestinal parasites ranging from 18 to as high as 90 per cent. of the juvenile population in such places, the problem demands careful

study. De Buys and Dwyer⁵⁰ made a study of the stools of nearly 600 persons in seven institutions. The observations indicate that the symptoms commonly regarded as showing the presence of "worms" are by no means dependable for purposes of accurate diagnosis, such as grinding the teeth, scratching the nose, etc. Either the parasites or their ova should be found in the feces before the enforcement of anthelmintic treatment. The personal habits and environment seem to have a direct bearing on the frequency of intestinal parasitic infection. It is significant that in the institutions in which they were most prevalent, systematic medical inspections were never made.

Rectal Disease. Brav⁵¹ states that hemorrhoids are rarely found in infants. Prolapsus recti, however, frequently occurs, polypus recti is not an uncommon disease and procidentia recti is of frequent occurrence in children. Anal fissure is more common in infants than in older children. Fistula in ano is very rare in infants and children, Fecal impaction is occasionally met with.

Pica. Pica suggests an appetite for substances which are not foods, such as soap, plaster, dirt, chalk, etc. It has been frequently noted among the lower animals, especially lambs. It is common among the insane, idiots and imbeciles. Thompson has separated pica as it occurs among infants and children into two classes, though he admits it is not always easy to determine to which class a particular case belongs: (1) Those in which the habit begins at any age with decided deterioration in the general health, anemia usually being a symptom. Patients belonging to this class are usually suffering from a variety of abnormal conditions curable or incurable, including rickets, bronchitis, round worms, tumors, tuberculosis. (2) The larger number in which the craving develops in early infancy, as opportunity for its indulgence offers, gradually passing off when the child approaches its third year, even without treatment.

Benson⁵² presents a case of pica with a careful review of recent writings on the subject. He finds that a majority of cases are associated with a nervous temperament and digestive disorders, especially chronic gastro-intestinal catarrh. Some writers insist it is only an exaggeration of a normal habit among young children to put everything into the mouth which comes within reach of their hands. Koplik⁵³ classifies pica among "bad habits" and does not consider it as necessarily coming under nervous disturbances, and finds it difficult to say, from a purely clinical standpoint, whether pica leads to any serious results. Holt⁵⁴ places it among the functional nervous diseases and considers it akin to other injurious habits of infancy and childhood. Thompson⁵⁵ gives a comprehensive outline for treatment. He rarely uses medicines and presents four therapeutic measures: (1) Do not allow the child to obtain the substance for which he has the craving. (2) Rectify any digestive disturbance by due attention to diet. (3) Improve

⁵⁰ American Journal of the Diseases of Children, October, 1919.

⁵¹ Pennsylvania Medical Journal, September, 1919.

⁵² New York State Journal of Medicine, May, 1919.

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ Ibid.

the general health. (4) Whenever possible, change the environment, occupy the mind with new experiences, keep the child busy and happy.

Kidney and Bladder Disease in Children. Lozano and Ruiz⁶⁶ give full details of 25 cases of these diseases, all but 5 in girls. Ten were between two and five years, 6 less than one year; 4 between one and two; 4 between five and thirteen. The colon bacillus alone was found in 25 per cent., and associated with other germs in 33 per cent. The disease was primary in less than 15 per cent. of these cases; in 33 per cent., it followed gastrointestinal disease; 25 per cent. measles and 10 per cent. infectious sore-throat. The first symptom to attract attention is usually high fever, remittent or irregularly intermittent, often accompanied by chills and sweats. Cystitis is less frequently accompanied by chills, particularly in older children. The diagnosis is confirmed by pallor, possible pus in the urine and disturbances in micturition. The discovery of renal cells points to the kidney. The kidney, and pelvis and bladder may all be involved. Tuberculosis is suggested by the absence of bacteria from the urine, but 1 case with negative findings seemed of toxic but non-tuberculous origin. With the exception of 3 tuberculous cases, there was no mortality in the 25 cases. During the course of acute infectious disease, the kidneys should be carefully watched and abundant fluids should be given. Small doses of hexamethylenamin are recommended by the authors. The genital organs should be kept scrupulously clean. During the febrile period the child should be kept in bed and fed with milk and large quantities of water. If it does not like to drink, the water can be given in enemata or passed through a tube into the esophagus. Alkalines are said to discourage the colon bacillus, but large doses usually have to be given for this, every two hours for eight or ten days. The author's experience with this has not been especially successful. Salol is irritating to the kidneys, and should not be given if they are involved. Epinephrin has proved very useful with them. It is especially potent in pyelonephritis cases. They use from 4 to 6 drops per year of age approximately of the 1 per thousand solution, along with 0.75 to 2 gm. of hexamethylenamin, continuing it until pus disappears from the urine. If this treatment does not suffice, they advocate an autogenous vaccine. In the case of colon bacillus pyelonephritis that had lasted for four months, the cure was soon complete under vaccine therapy, as also in a case of lactic aërogenes pyelocystitis, which had been flaring up repeatedly for fifteen months. In one other case treated with vaccine, simple improvement was observed. Local treatment of the bladder is seldom needed. Pain is relieved by hot applications.

Enuresis. Provinciali⁶⁷ states that eight out of ten children suffering from essential enuresis revealed anomalies in the lumbar-sacral portion of the spine under roentgen examination. In only 2 cases did these parts present a normal appearance. These children showed no other appreciable signs of degeneracy, or only in a proportion much less than in adults. As children usually outgrow the enuresis in time, he urges

⁶⁶ Archivos Españoles de Pediatría, Madrid, July, 1919.

⁶⁷ Pediatría, Naples, September, 1919.

roentgen examination of the spine in the hope of detecting the nature of the anatomic changes which put an end to the enuresis.

Chorea and Rheumatism. Cronk⁵⁸ reports a study to determine the relation existing between chorea and rheumatism. He has made a study of two series of patients from two to fourteen years of age, each group containing 200 children. He demonstrates most convincingly the connection existing between these two conditions.

Malaria. In the southern portion of the United States, malaria is frequently seen by physicians among children, but its occurrence is unusual in infants under six months of age. Medical literature has not given much information regarding the signs and symptoms of malaria in the very young. Bloom⁵⁹ reports 2 cases from which he draws the following conclusions: Tertian malaria does occur in infants, though it is unusual. The common symptoms noted are; marked cachexia, a corresponding marked diminution in hemoglobin, and in the red blood cell count, enlarged spleen, prolonged temperature (atypical as compared with adults). A soluble preparation of quinin, 0.4 of a grain in three doses, was given for seven consecutive days and thereafter every other day for a month.

Care of the Nervous Child. McCready⁶⁰ says the nervous child presents certain stigmata of degeneration, which he enumerates. Nervous inadequacy he considers the rule rather than the exception in modern life. Nervous stability in the adult depends on hereditary endowment and on the stimulative developmental force of nature and nurture. Nervous instability results from hereditary deficiency in developmental forces, hereditary deficiency aggravated by inadequate stimulation through nurture, malign factors in the environment affecting an inherited sound constitution. Early childhood is the time for the institution for corrective measures. The aim should be to stimulate and stabilize developmental forces and remove or counteract unfavorable factors in the surroundings. The modification of environment is the first factor to receive attention. The home is often at fault. If the child remains in his home, he should be under the care of a physician and his orders should be strictly carried out. The child must have rest. Fatigue must be avoided. It is best to remove the child if proper environment cannot be secured in the home. Many children in well-to-do homes are not well nourished. The children are not given as much care as is given to live stock. Three prime requisites for the raising of stock are, proper food in proper amount with the different food elements properly balanced. In addition, exercise and fresh air are necessary; these same requisites apply to children. The modern apartment is a pest for anyone, especially the child. The child must return to a more primitive form of life. He should study nature and not books. The conventions of the modern school do not meet the requirements of the nervous child. Eaton⁶¹ considers that some children are born nervous, perhaps a greater number acquire nervousness, but the majority had nervousness thrust

⁵⁸ *Lancet*, October 11, 1919.

⁵⁹ *American Journal of Diseases of Children*, December, 1918.

⁶⁰ *Archives of Pediatrics*, July, 1919.

⁶¹ *Ibid.*

upon them. A paramount duty of the pediatrician is to teach mothers and nurses and the rising generation of girls these points upon which the child may be shipwrecked. The tendency of "back to the soil" should be encouraged. He believes in making machines of children as far as regularity of life goes. Regular habits should be cultivated from the moment of birth.

Ticks. Todd⁶² has accumulated evidence which seems to prove beyond a doubt that ticks may cause paralysis in human beings, especially children. In rural districts physicians who have the care of progressive and sudden paralysis should always make careful search for a tick. The region most likely to be attacked is the back of the head and neck. In case a tick is discovered, it should be carefully removed whole and alive, if possible, and sent to a laboratory for examination and identification. If the tick's head is left in the wound, the bite often becomes infected and an ulcer is formed. Particularly severe infections have been known to follow the bite of a tick. It would be useful if practitioners encountering trouble caused by these pests, would report their cases, and record their experience.

Foreign Bodies in the Air and Food Passages. Graham, of Philadelphia, in his presidential address before the American Pediatric Society related his observations on a large number of cases of foreign bodies in the air and food passages, a larger number in the air passages. He concludes: (1) Such accidents are more frequent than is usually supposed. About 66 per cent. of all such cases occur in children. (2) The time passing between the dyspnea and choking attack and the onset of consequent symptoms is so great as to often mislead one in making the diagnosis. (3) Foreign bodies are certainly often overlooked as a study of the histories of many of the cases reported show. (4) The symptoms vary greatly. The peanut kernel immediately sets up a severe laryngitis, tracheitis, and bronchitis. In the peanut cases older children may survive the acute symptoms, but almost surely develop pneumonia. (5) Metal objects remain in the lung a long while and do little harm, comparatively. (6) Some foreign bodies do not cast a shadow on the x-ray plate. (7) The location of a foreign body in the esophagus that does not cast a shadow on the x-ray plate can often be diagnosed by allowing the patient to swallow a bismuth-filled capsule. The x-ray shows the position of the bismuth capsule held in position in the esophagus by the foreign body. (8) The patient should not be urged to cough in the hope of expelling the substance inhaled in the lungs. (9) Foreign bodies are very rarely coughed up. (10) The physical signs and symptoms vary according to the composition, form, shape and size of the foreign body. (11) One should suspect a foreign body, if the following conditions are present: an unexplained leukocytosis, localized symptoms in one lung that do not clear up under treatment, no tubercle bacilli in the sputum, and a gradual failure in the weight and strength. (12) There are no contraindications to bronchoscopy except, perhaps, weakness of the patient, when time should be given for the patient to rally in part. (13) Bronchos-

⁶² Canadian Medical Association Journal, November, 1919.

copy should be performed as soon as possible after the entrance of the foreign body. (14) Children do not require the administration of an anesthetic for the performing of an bronchoscopy. (15) The necessity of taking a radiograph of every case giving a history of swallowing a foreign body cannot be too strongly emphasized. (16) The asthmatoïd wheeze is a symptom of considerable importance.

I saw a child some years ago who had been thought to inhale a piece of cork. After a long and serious illness from pneumonia, she, after a terrible coughing spasm, spit out a mass of pus in which was found a piece of cork of considerable size.

Cerebrospinal Fluid in Infantile Spasmophilia. Giovanni Genoese⁶³ states that in the spasmophilic syndrome of infancy there is almost constantly increased cerebrospinal pressure due to augmentation of the spinal fluid. The albumins are usually found to be normal as well as the chlorides. Certain cases present a definite acetone reaction in accordance with the finding of this substance in the urine. The cell count is invariably negative. Repeated lumbar puncture does not give constant results although the symptoms may be relieved for a short time.

Rickets. Cannata⁶⁴ relates that out of 10,000 children passing through his clinic in the past five years, 1285 were rachitic. He found that 37.27 per cent. of these children had inherited syphilis. Excluding those with tuberculous or chronic skin disease, there were 58 breast-fed infants in whom the rachitis seemed to be connected with the inherited syphilis, and the latter dominated the clinical picture. The symptoms described by Marfan as characteristic of rachitis with inherited syphilis, were found equally pronounced in eighteen infants under six months old, who seemed to be free from all inherited taints.

⁶³ *La Riforma Medica*, June 14, 1919.

⁶⁴ *Pediatria*, Naples, September, 1919.

RHINOLOGY, LARYNGOLOGY AND OTOTOLOGY.

By WILLIAM H. SPENCER, M.D.

The Ear. In observations and experiments attempting to decide whether the Eustachian tube is normally patent or not, Caldera¹ found 3 subjects in whom there had been formed a cicatricial diaphragm or false tympanic membrane. In all 3 cases it was noticed that the membrane moved alternately inward and outward with the movements of respiration. This would seem to demonstrate that in normal conditions the tube is open. Caldera thinks that the objection that the tubes in question were not normal can be ignored, and explains the condition by the fact that the membrane had not the support of the malleus nor of the middle strong fibrous layer of the tympanic membrane and was therefore much more supple. He maintains that the above facts confirm the contention of Hammerschlag and Lucae that the tube is normally open to currents of air during respiration.

Hearing Test to Detect Malingering. The following technic has been evolved by Callaghan² in order to determine whether there is actual deafness in cases suspected of malingering. The basis of his test is the fact that tuning-forks vibrating with the same pitch and loudness 1 inch from each ear are heard in each ear, but if one fork is removed to a point 3 inches from, let us say, the left ear, this sound is lost and only the fork remaining 1 inch from the other ear is heard. If the latter fork is now removed 6 inches from the right ear, it will no longer be heard, but the left one will again become audible. Callaghan found that similar results were obtained if a tuning-fork was placed against a rubber tubing, and his experiments were first conducted with a stethoscope as the tube. He now uses a 7-foot length of rubber tubing, hole $\frac{1}{8}$ inch, wall of tubing $\frac{3}{8}$ inch, to either end of which is attached an aluminum funnel. The funnels are held to the ears, and about 1 inch away from them, by a simple attachment on the headrest of the examining chair, which permits of adjusting them to cover the ears without touching the patient. As the test is one of air conduction, it is important that no part of the apparatus comes into contact with the patient's person at any point. Callaghan found that tuning-fork 256 C 1 was heard by the normal ear when placed against the tubing at any point up to $7\frac{1}{2}$ feet from the ear; with a larger size tubing the fork is heard as far away as 30 feet. As a routine, however, he used the $\frac{1}{8}$ inch, $\frac{3}{8}$ tube mentioned.

The application of the test is as follows: The 7-foot tube is connected with one funnel which is placed about 1 inch from the right ear. The

¹ Arch. Ital. di otol., September, 1918, No. 3, vol. xxix.

² Boston Medical and Surgical Journal, August 15, 1918.

tuning-fork vibrating is applied to the tubing about 6 inches from the ear and is then moved along the tube until no longer heard. The tube is then disconnected from the right funnel and attached to the left and the same procedure followed. After this, the tube is attached to both funnels; the vibrating fork is applied to the tube 1 foot from the right ear and moved along the tube toward the left ear. If hearing is normal, the sound will be heard only in the right ear until it reaches a point about 3 to 3½ feet from the right ear, at which point it will be heard also in the left ear and will continue to be heard in both ears for a distance of about 4 to 6 inches in the middle of the tube; this 4 to 6 inches the author calls the "neutral" space. Beyond this, the sound is heard only in the left ear. Callaghan points out that whereas when the tube is attached only to one ear, as in the first part of the test, the sound is heard for 7 to 7½ feet, when attached to the two ears, it is heard only up to 3 or 3½ feet, because as the tuning-fork passes through the neutral space from the right to the left ear, the sound is heard only in the latter ear.

As these tests are done behind the patient's back, he does not know whether one or two tubes are being used or which ear is nearer the tuning-fork, and it is easily possible to detect any misstatements he may make in regard to his hearing. An 8-foot tubing may be used and may be cut about 14 inches from one end and joined by a simple wooden coupling—such as a meat skewer cut to 2 inches in length and tapered at either end—or, preferably, a coupling of hard rubber tubing. This makes it possible to determine exactly which ear is hearing the sound, as the tube can easily be uncoupled and the fork touched to one end or the other.

The degree of hearing can also be determined by this test modified as follows: Two tubes are taken, each the length of the hearing in the good ear. Funnels are attached to both ears. The fork is touched to the end of the tube connected with the good ear and at exactly the same time a fork is touched to the other tube near the head and is run down that tube. As the fork is touched further away from the bad ear the patient will cease to hear it and if malingerer, will then admit hearing for the first time. This point will be the measure of the distance he hears with the bad ear. Callaghan's test can be applied for bone conduction by the use of lugs, as the vibrations transmitted along the tubing are easily transmitted through lugs to the bony parts in the region of the ear. All that is necessary is to place the funnel in contact with the cranial bones of the ear. In applying the test, the author states that he always uses a tube which is 6 inches shorter than the distance of hearing in the good ear of the patient.

Lip-reading as an Aid to the Partially Deaf. The otologist is sometimes remiss in not unfolding to his "hard of hearing" patients the value of lip-reading. Scripture³ and Kessler⁴ emphasize the importance of beginning the instruction before the patient has complete loss of hearing. By the aid of lip-reading the patient can continue his social and business relations thus maintaining interest in life and avoiding that introspec-

³ Laryngoscope, June, 1918.

⁴ Ibid., March, 1919.

tion and moroseness so frequently seen in the deaf. With lip-reading to rely on, deafness is neither an affliction nor a curse, even though it remains an inconvenience.

Otosclerosis. The etiology of otosclerosis has been said to be due to an altered ductless gland secretion, and the fact that this disease makes its appearance about the time of, or just after, puberty, when the ductless gland system is rearranging itself, lends reason to this hypothesis. Pollock⁵ calls attention to the fact that we must seek further cause for this alteration in the internal secretions. It is his opinion that there exists a chronic focus of infection which may be in the tonsil, accessory sinuses, appendix, gall-bladder, teeth or other region. The treatment consists in removing the offending focus of infection and afterward attempting to restore the harmony of the ductless gland system. As there exists usually a hyposecretion of the adrenal gland or hypophysis, adrenalin or pituitrin is given by hypodermic injection. The dosage is regulated by observing its effect upon the blood-pressure; when the blood-pressure rises above what it was before the treatment was instituted, further treatment is delayed until the blood-pressure is again normal for the individual. Generally speaking, 3 minims of adrenalin are at first injected three times a week, the amount being increased gradually so that at the end of eight weeks, 10 to 12 minims are injected. After a period of rest of from four to six weeks, the treatment is again started, beginning this time with 5 minims and gradually increasing until 15 minims are used. In this manner, with periods of treatment and rest for about a year, the author claims very gratifying results. Tinnitus is said to be lessened and, although the hearing is not improved, further progress of the deafness is stayed. When the hearing is almost totally destroyed, no benefit has been derived, so that the earlier in the course of the disease the treatment is begun the better are said to be the results.

Vertigo. The subjective sensation of a disturbed relationship of one's own body to surrounding objects in space, termed vertigo, is a disturbance perceived in a definite part of the brain. The internal ears and the intracranial pathways constitute the apparatus that keep us from being dizzy, and the semicircular canals preside over our equilibrium. Vertigo is, therefore, due to a disturbance in the labyrinth or in any of the intracranial pathways. Some of the conditions which may cause vertigo have been classified by Reed⁶ as follows:

1. Involvement of the ear mechanism by a lesion in the ear itself.
2. Involvement of the ear mechanism by a lesion affecting the intracranial pathway from the ear.
3. Involvement of the ear mechanism by ocular disturbance, either through the eye muscle nuclei or through association of fibers from the cuneus to the first temporal convolution.
4. Involvement of the ear mechanism by cardiovascular disturbance.
5. Involvement of the ear mechanism by toxemia from any organ or part of the body.
6. Involvement of the ear mechanism from reflex irritation.

⁵ Illinois Medical Journal, November, 1918.

⁶ Journal of the Missouri State Medical Association, March, 1919.

The General Practitioner and Middle Ear Affections. A résumé by Scarlett⁷ of the recognition and treatment of acute middle ear disease should be read by every general practitioner, for the prevention of impaired hearing, many cases of mastoiditis, and of meningitis rests largely on the physician who first sees the patient. He should know the landmarks of the normal ear and should be able to detect the existence of any pathological condition of the drum or its neighboring structures. This will require familiarity with the use of the head mirror and the ear speculum. Inflammation within the middle-ear cavity may show only redness and slight swelling of the drum, but with appearance of fluid, usually pus, the normal landmarks are disturbed as the result of the bulging, and an inflammatory exudate is invariably spread over the outer surface of the tympanic membrane. Sagging of the upper wall of the external canal, corresponding to the anterior wall of the mastoid, should make one suspicious of involvement of the mastoid cells. Corroborative evidence, of course, should be obtained before making a positive diagnosis.

The first point in the consideration of the treatment is the relief of pain. A brisk saline cathartic is indicated, and rest in bed is essential. Dry heat applied in the form of a hot water bag is usually acceptable to the patient. Moist heat is objectionable in that it seems to aggravate the condition. It favors venous engorgement, softens tissues, and hastens local necrosis, rather aiding the development of the process we are attempting to abort. Blood-letting by the application of leeches may be of benefit, but is now seldom resorted to, preference being shown by most men for other forms of treatment. Attention to the nasopharynx and depletion of the tissues surrounding the orifice of the Eustachian tube are important, in order to encourage drainage from the middle ear. This will sometimes produce surprising results. An oily solution containing camphor, menthol, and eucalyptus may be used to advantage in the nose. The effect is at least pleasing to the patient. The dropping of oily solutions into the external auditory canal for the relief of pain should be condemned. The oil possesses little or no therapeutic value and only serves to obscure the parts for future examination. Sweet oil and laudanum, so frequently used by the laity and many physicians, is included in this class. Any virtue that might be claimed for this preparation is due simply to the heat of the solution, which is soon dissipated. The epidermic covering of the external surface of the drumhead does not permit free enough absorption for the laudanum to produce sedative action. There is no objection to phenol and glycerin in a 5 or 10 per cent. solution; in fact, this preparation is often advocated and seems frequently efficacious in the relief of pain. Many believe that the only indication for an oily solution in the ear is for scaly eczema of the external canal, or as a dressing for dermatitis.

If the various applications do not produce the desired relief within twelve hours, an incision should be made in the tympanic membrane, and especially if fluid in the middle ear is detected. Those who have

⁷ New York Medical Journal, April 6, 1918.

suffered the agonizing pain of an "earache" can readily appreciate the benefit of an open drum. Even if no pus is obtained by an early incision, and not infrequently such is the case, marked relief is obtained by the depletion of the part as the result of the bleeding. It is now considered poor judgment and careless practice on the part of the physician to allow a patient to suffer, beyond a reasonable time, until the drum is ruptured by the force of the pus behind it. Such a perforation is harder to heal than if the incision is made and frequently it does not furnish adequate drainage, thereby predisposing the ear to a chronic suppurative condition.

Measles and Acute Otitis Media. Harris⁸ reports the number of ear cases from January 1, to July 14, 1918, on his service in the U. S. A. General Hospital, No. 14, Fort Oglethorpe, Georgia, was 1685, of which 607 were cases of measles. It was a striking feature in the acute otitis media complicating measles that there was a total absence of pain, either subjective or objective, as far as the ear was concerned. In a great majority of the cases the ear complications were discovered only in the course of a routine examination. Early and free incision allowed most of the cases to go gradually to convalescence and recovery. Some of the cases, if the organism present, usually a streptococcus or pneumococcus, was exceedingly virulent, when free drainage had not been established early, and in patients of lowered resistance, went on to mastoiditis. Acute mastoiditis appearing in a patient suffering from measles was found to be just as free from pain as otitis media. The patients would scarcely admit any tenderness on pressure over the antrum or tip. The only sign that could be depended upon was a change in the upper posterior wall of the canal, which was considered an indication for immediate operation. If operation was delayed, it was common to meet with epidural abscess, sinus thrombosis, brain abscess or meningitis.

Thirty-one mastoid operations complicated by measles were done under nitrous oxide-oxygen anesthesia. The shortest period of administration was forty minutes, the longest, three hours and forty-five minutes. The author considers this to be an ideal anesthesia for such cases; absolutely no shock following the operation.

Porter⁹ has had good results in the use of local anesthesia in mastoidectomies, one a bilateral operation. The patient is given $\frac{1}{4}$ grain of morphine subcutaneously one-half hour before operation. A 0.5 per cent. solution of cocaine or procaine is injected along the line of skin incision. The injection is carried next into the deeper layers and finally under the periosteum over the entire area of the mastoid. The insertion of the sternomastoid muscle and the posterior canal wall are injected last. After waiting from five to ten minutes, the operation is started and carried on in the usual manner. The patient usually complained somewhat of the pounding necessary to remove the cortex, but admitted afterward that there was no actual pain. There was a total absence of shock.

⁸ *Annals of Otology, Rhinology and Laryngology*, March, 1919, vol. xxviii, p. 50.

⁹ *Journal of the American Medical Association*, 1919, vol. lxii, p. 546.

Influenzal Otitis Media. The comparative infrequency and the characteristics of aural complications in the recent influenza epidemic are well brought out in the excellent discussion of the subject by Hill¹⁰ made during his stay at Fort Oglethorpe. Out of a series of 6870 cases of influenza occurring at the U. S. A. General Hospital, No. 14, there were only 120 cases of acute suppurative otitis media. There were 1600 cases of pneumonia in this series, and 66 of the cases of otitis media occurred among these. Of the 120 cases, 17 were bilateral, 16 of these occurring in the pneumonias; 21 cases developed mastoiditis, 2 of these being bilateral; 1 case developed otitic meningitis and died. The percentage of influenza which developed acute suppurative otitis media as a complication was 1.75 per cent. About 50 per cent. of these occurred in cases having pneumonia. Therefore we must conclude that the percentage of otitis media occurring in influenza is comparatively small, the greater proportion occurring in those cases complicated by pneumonia.

This type of otitis media showed first a hyperemia and then an acute hyperplasia or hyperplastic edema of the mucous membrane of the middle ear. This gave a certain definite and characteristic picture including a drooping of the canal wall. The last sign was not found indicative of suppurative mastoiditis by symptoms, signs, radiographic examination or results. The operative signs indicative of suppurative mastoiditis were found to be increased purulent discharge and thickened mastoid periosteum, pain and slight rise of temperature. Many of the cases speedily convalesced after incision of the drum; in a few, because of the hyperplastic inflammation, secondary incision of the drum became necessary; in others, the inflammation was prolonged for two weeks or more. Cultures made showed the presence of streptococci in practically every case.

Conner,¹¹ in reviewing the statistics of influenza, states that in the Base Hospital at Camp Hancock in all cases of influenza a systematic and regular examination of the ears was carried out. Among 7800 cases of influenza, an otitis media sufficiently pronounced to call for incision of the drum was found 300 times, or in about 4 per cent. of cases. Among these 300 cases of otitis, a mastoiditis of sufficient severity to demand operation occurred only four times.

Simple Rupture of the Ear Drum. Simple rupture of the ear drum from explosions of shells or the proximity to detonations was observed by Chavanne¹² in 234 cases. Linear ruptures were the most frequent and were usually single, but in 41 cases multiple ruptures were seen. After a simple rupture of the tympanic membrane complete cicatrization ordinarily occurred as following a paracentesis. In ruptures of sufficient size to destroy a definite amount of the substance of the ear drum, an acute purulent otitis media was an almost constant complication. The functional symptoms usually promptly subsided, and the deafness usually disappeared. He concludes that simple rupture of the ear drum

¹⁰ *Laryngoscope*, June, 1919, No. 6, vol. xxix, p. 351.

¹¹ *Journal of the American Medical Association*, August, 1919, No. 5, vol. lxxiii, p. 321.

¹² *L'Oto-rhino-laryngologie internat.*, March, 1919, p. 98.

is generally benign. It is exceptional that it accompanies grave labyrinthine disturbance causing definite deafness. In cases of labyrinthine disturbance due to explosions, the production of a tympanic rupture is perhaps a beneficial factor because of the immediate decompression realized. Healing was ordinarily effected rapidly; 36 per cent. of the cases required one month or less; 49 per cent. of the cases requiring between one and two months.

A larger number of ear drum ruptures (543) were complicated by purulent otitis media, later infection resulting from the external auditory canal or from the nasopharynx, sometimes from misdirected treatment, notably untimely lavage. Eleven cases of mastoiditis occurred. The greater number, however, made rapid convalescence. Return to service was made in one month or less in 21.9 per cent.; after a period of one to two months in 34 per cent.; of two to three months in 18.7 per cent.¹³

Moure and Rozier,¹⁴ after an anatomico-clinical study, believe that there exists a special form of purulent inflammation in the postero-inferior portion of the mastoid process which they term "Posterior Mastoiditis." It is manifested by a perforation either of the internal cortex or the external cortex, and a propagation of the infection either toward the neck or the occiput, resulting in a cervical or occipital abscess. The abscesses do not have the uniform clinical signs described by Bezold; their formation and situation is said to vary: (1) with the disposition of the posterior mastoid cell, which may be postero-superior, posterior, or postero-inferior; (2) with the site of perforation of the cortex; (3) with the muscular and aponeurotic topography of the region, for pus inevitably extends along the muscles that take their origin from the mastoid process; the sternomastoid, splenius, complexus and digastric. Therefore, the abscess may be situated in the retromaxillary space; it may lie between the posterior border of the sternocleidomastoid muscle and the anterior border of the trapezius; it may develop in the nape of the neck; or it may follow the sternomastoid muscle and lie among the great vessels situated under the muscle. In any case the treatment consists in prompt surgical intervention to prevent cerebral complications or diffusion of the abscess to all the deeper portions of the neck. Three steps must be followed: (1) Evisceration of the mastoid cells; (2) search for the bony fistula; (3) extensive opening of the cervical abscess. The retro-auricular wound is closed, leaving a drain in the antrum, and drainage is inserted into the cervical abscess.

Mastoid Dressing. Herbert Tilley¹⁵ has had good results in dressing his mastoid wounds with Prof. Rutherford Morison's bismuth iodoform and liquid paraffin paste, popularly known as Bip. He cleanses the wound with swabs moistened with methylated spirit, smears the parts with the paste, and sutures the external wound in its entire length. A dry sterile dressing is placed over the field and held in place by a bandage.

¹³ *L'Oto-rhino-laryngologie internat.*, April, 1919, p. 148.

¹⁴ *Revue de Laryngologie*, 1918, No. 5, p. 101.

¹⁵ *Journal of Laryngology, Rhinology and Otology*, London, March, 1919, vol. xxxiv, p. 73.

The parts heal kindly, absence of inflammatory reaction in the soft tissues being particularly noted. No evidence of iodoform poisoning has been encountered.

Eagleton¹⁶ advocated the filling of the mastoid wound cavity with bone grafts and chips. He cites 2 cases so treated in which excellent results were obtained both from the functional and cosmetic point of view. In 1 case the mastoid wound was reconstructed in a secondary operation following sterilization of the wound cavity by the Carrel-Dakin method. In the other case the mastoid wound cavity was filled with bone graft and chips at the primary operation; grafts and chips being obtained from the tibia.

Carrel-Dakin treatment has been advocated by a few of the operators but the constant care required has not endeared it to the hearts of many. Dichloramin-T has its adherents and of the two would seem the more popular method.

As a means of antisepsis in the mastoid operation, Jervy¹⁷ washes out the Eustachian tube by means of a catheter inserted in the usual manner, or with the aid of Holmes pharyngoscope, into the Eustachian orifice through the nose. A 1 to 5000 solution of bichloride is forced through the Eustachian tube, middle ear, antrum and out through the exposed mastoid field. It is his opinion that secondary infection is less apt to occur and that healing is hastened by this procedure.

PARAFFIN DRESSING FOR RADICAL MASTOID. Carrel's method. Speedy epidermization and painless dressings are said to be the advantages of filling the wound cavity with a paraffin which melts at about 50° C. Daure¹⁸ describes the technic as follows: The retro-auricular wound is immediately sutured and the cavity carefully dried with pledgets of cotton; the head so placed that the meatus is in the horizontal plane. Paraffin is poured into the cavity and two or three wicks are incorporated in the mixture before it solidifies. The block of paraffin is removed five or six days later by traction on the wicks and subsequent dressings are performed as the original at two- or three-day intervals. As a rule, epidermization is complete in from three to five weeks. The paraffin dressings may be superseded after the third week by boric-alcohol or powdered boric acid.

BLOOD-CLOT DRESSING OF MASTOID. The technic advised by Davis¹⁹ consists in packing the wound for twenty-four hours with iodoform gauze. At the end of this time the packing is removed and the wound cavity allowed to fill with blood. If not enough blood is forthcoming, a nick is made in the margin or angle of the flap. In simple mastoidectomy, the lower angle of the wound is now closed with adhesive plaster, with removal of the sutures on the second or third day. In radical mastoidectomy, the postauricular wound is closed completely, the iodoform gauze packing, inserted through the large meatus, is removed in twenty-four

¹⁶ Laryngoscope, May, 1919, No. 5, vol. xxxix, p. 273.

¹⁷ Transactions of the American Laryngology, Rhinology and Otology Society, 1918.

¹⁸ Bull. de l'acad. de méd., March 19, 1918.

¹⁹ Journal of the American Medical Association, January 18, 1919.

hours and the wound cavity allowed to fill with blood; the meatus is covered with sterile dressings which are changed daily.

Otitic Meningitis. Otitic meningitis is no longer an inevitably fatal complication, for numerous are the single cases of recoveries reported in the literature, even brain abscess is assuming a less formidable mien. Earlier operations on the mastoid with repeated drainage of the spinal fluid and in some hands the intraspinal injection of various antiseptics in colloidal solution have quite altered the outlook for these cases.

Aboulker²⁰ condemns the practice of opening the dura in the depths of an infected mastoid wound. He advocates and practices the opening of the dura for exploratory or decompression purposes in the temporal or occipital region, in an aseptic operating field where there is no risk of introducing an infection. By this method and the intraspinal injections of electargol, he has cured 16 cases of otitic meningitis. In the septic form of meningitis, he²¹ makes an opening in the exposed mastoid portion of the dura and a counter opening in the temporal or occipital region of the opposite side.

In his usual masterful manner, Dench²² summarizes for us the symptoms and treatment of otitic meningitis from the American point of view. A distinction must be made between true meningitis and meningitis coincident with otitis. The term "serous meningitis" he considers a misnomer, classifying the meningeal irritation symptoms and meningismus as the first stage of otitic meningitis.

Otitic meningitis is an inflammation of the coverings of the brain, due to middle-ear infection. The simplest form is the extradural or epidural abscess occurring oftenest near the lateral sinus or middle cranial fossa and characterized by the symptoms of insomnia, localized headache over the abscess, tenderness on percussion, and slight elevation of temperature. The involved dura offers a barrier to the entrance of organisms into the arachnoid and pia.

The true meningitis is divided into three groups: (1) Fulminating cases; (2) regular or frank cases; (3) latent cases. Little difficulty is found in diagnosing the fulminating cases. There is a sudden onset of severe headache, vomiting, and high temperature. Variable eye symptoms, such as photophobia, irregular pupils, paresis of the ocular muscles with internal strabismus, manifest themselves. Opisthotonus develops, and the Kernig and Babinski signs make an early appearance. Delirium, quickly followed by stupor, and Cheyne-Stokes respiration occur. The pulse becomes slow owing to the increased intracranial pressure which is also manifested by the signs of choked disk. The spinal fluid, found to be under greatly increased pressure, is turbid, cell count and globulins greatly increased, and pathogenic organisms are found, usually in smears of the fluid, and always upon culture. A fatal termination usually occurs within from twelve to forty-eight hours after the inception of the symptoms.

The regular or frank cases manifest similar symptoms but of lessened

²⁰ *Rev. de laryngol.*, March, 1919, p. 97.

²¹ *Ibid.*, May, 1919, pp. 193-217.

²² *Laryngoscope*, 1918, vol. xxviii, p. 501.

intensity. When the disease results as an invasion through the internal auditory meatus, there are symptoms due to the involvement of the internal ear, such as profound or absolute deafness, vertigo, and nystagmus, first toward the affected side, but quickly changing to the diseased side, as soon as the labyrinth becomes greatly involved. An early symptom of value in the first stages of meningitis, in which the infection occurs through the internal auditory meatus, is, that the direction of the nystagmus can be changed by shaking the head. In patients with normal labyrinths, shaking the head violently causes no nystagmus because of the free circulation of the labyrinthine fluid. With a change in the character of the fluid, however, its movement in the semicircular canals is not so free, consequently, sudden changes in the position of the head are followed by nystagmus. The caloric test here will also show a delayed response or the labyrinth may be absolutely dead.

Latent meningitis frequently follows operations on the middle ear and mastoid. The first symptoms are general malaise, moderate temperature elevation and some headache. Vomiting is, perhaps, the most constant symptom, and emesis which persists longer than one would ordinarily expect after the administration of a general anesthetic, or when this vomiting is more severe than usual, should arouse suspicions of meningitis. There may be slight rigidity of the neck, the Kernig sign is usually doubtful, there is no delirium, the mentality is clear and the patients do not seem very ill. The cerebrospinal fluid may be under pressure; the globulin and cell count are above normal. It is this latent stage which perhaps offers the best period for operative intervention, its recognition is, therefore, of extreme importance. A differential blood count is of great value as there is often found a leukocytosis as high as 20,000, while the polymorphonuclear percentage may be 90.

Operative procedure consists in the removal of the primary cause of infection, exposing a large area of dura, with subdural drainage in fulminating cases, and frequent lumbar punctures. In cases of labyrinthine invasion, the labyrinth should be extirpated and the subdural space in the vicinity of the internal auditory meatus drained. Dench considers intravenous injections of serum and intraspinal injections of urotropin valueless.

NOSE.

Nasal Obstruction in Aviators. Douglas Guthrie²³ summarizes the effects of nasal obstruction on the aviator as (1) On the lungs: The chest is never satisfactorily expanded or the lungs sufficiently aerated. Serious "oxygen want" results. (2) Equilibration: The Eustachian tubes are impaired in function, there is resulting alteration of labyrinthine tension, communicated from middle to inner ear by round and oval windows. The risk of a crash is, therefore, considerable. (3) "Reflex" effects. Headache, mostly due to pressure of deflected septum against the middle turbinal. The causes of nasal obstruction in aviators are adenoids, hypertrophic rhinitis, and septal deviations. Polypi

²³ Lancet, 1919, vol. i, p. 136.

were encountered by Guthrie only once. He insists upon the fact that a degree of nasal obstruction which would cause little trouble on the ground may be very troublesome in the air. The nasal mucosa becomes swollen and engorged at heights over 7000 to 10,000 feet. Treatment is therefore of some importance.

Infections of the Upper Air Passages. That the management of a case of influenza is essentially a nose and throat problem is the opinion of Voorhees.²⁴ His method of treatment consists in irrigation of the nasal fossæ with warm normal salt solution every hour if necessary, followed by the instillation of a 25 per cent. argyrol solution, 5 drops in each nostril. He believes there is less danger to the ears from salt solution properly employed than from leaving the bacteria free to be blown in by the patient in an unguarded moment or to gain entrance by other means. The oropharynx and tonsillar crypts are to be treated with 2 per cent. silver nitrate solution sprayed in with a De Vilbiss atomizer, or the tonsillar crypts may be treated with a stronger solution of silver nitrate applied locally. When the infection extends to the lower air passages, Voorhees recommends the instillation of antiseptic medication directly into the trachea; if this cannot be done, he considers it permissible to inject into the trachea through the cricothyroid membrane with a fine hypodermic needle, either 1 c.c. of a 2 per cent. solution of dichloramin-T, or 1 c.c. of a 5 per cent. solution of menthol in oil. The use of autogenous vaccines is strongly recommended. In view of the recent investigations by Meltzer on the irritating properties of the chlorine antiseptic preparations when injected into the bronchi and trachea, it would seem that further investigation should be made before these preparations are generally recommended for use in the lower air passages.

On the other hand, Mackenzie²⁵ considers that in order to guard against intranasal complications of epidemic influenza we should avoid the use of local applications to the nose and throat, for the reason that there is no antiseptic strong enough to destroy a virulent strain of the bacillus influenzae which would not at the same time injure and impair the resistance of the mucous membrane. Treatment tending toward establishment of a systemic increase of resistance on the part of the individual he considers of greatest value and emphasizes the necessity for the avoidance of alcohol.

Delavan²⁶ has found the use of dichloramin-T to be of advantage in the upper respiratory passages for the purpose of preventing the extension of newly acquired infections; to overcome the acute results of infection; and to abolish the bacilli persisting in carriers. A strength of 2 per cent. is said not be irritating, and stronger solutions may be applied to the tonsillar crypts. When the method fails, in the presence of hypertrophied tonsils and adenoids, the removal of these organs may be necessary to effect a cure.

²⁴ New York Medical Journal, October 26, 1918.

²⁵ New York Medical Journal, November 23, 1918.

²⁶ American Journal of Surgery, December, 1918.

Acute Infection of Accessory Nasal Cavities. Stucky²⁷ deprecates the needless and often dangerous use of surgical interference in the treatment of acute infection of the nasal accessory cavities because the average case of acute infection of these cavities will yield to medical treatment aided by the mildest local treatment. Zemer²⁸ says operative measures are inadvisable except when pus has broken through the wall of the ethmoidal and frontal sinuses into the orbit. He advocates cocaine and adrenalin applications, suction with the Coffin apparatus followed by hot alkaline irrigations. Relief is afforded by steam inhalations carrying benzoin or menthol. Potassium iodid, ammonium acetate and Dover's powder are also indicated.

Dean²⁹ holds that the end-results in surgery of the accessory nasal sinuses are dependent more on the pathologic condition than on the kind of treatment instituted. Most disappointing results are had with individuals suffering from pulmonary tuberculosis. It is his experience that in spite of the most prolonged and intensive syphilitic treatment, cases of sinusitis in syphilitic patients will not do well. Irrespective of the sinus involved, the presence of a marked chronic osteomyelitis involving bone which cannot be removed, gives a bad prognosis.

In the study of 100 cases, Babcock³⁰ finds that the pneumococcus is preëminently associated with acute attacks, and the streptococcus with chronic sinusitis; staphylococci being well represented in both groups. It was also noted that acute cases are more often associated with a single organism. In chronic staphylococcus cases there occurred the lowest percentage of cures, the highest percentage of operations and the greatest duration of time of treatment.

When operating upon a diseased ethmoid, Murphy,³¹ after removing a number of polypi and breaking down the anterior ethmoid cells, encountered a hard substance which on removal proved to be a supernumerary tooth.

Sinusitis in Children. A number of cases of sinus focal infection in children are reported by Dean and Armstrong.³² The difficulties of diagnosis are many, often necessitating repeated examination to find the offending sinus. The use of the nasopharyngoscope during general anesthesia for tonsillectomy is often of great aid, while a good radiograph is indispensable. Most of the cases studied were suffering from arthritis. The most common symptom found was sneezing; the other symptoms, as recurrent stoppage of the nose, frequent colds, headaches and nasal discharge, playing variable roles. The patient never complained of postnasal discharge. A condition characterized by listlessness, anorexia, underweight, poor color, so commonly caused by diseased tonsils and adenoids, which persists after the removal of the tonsils and adenoids, with a negative report from the pediatrician so far as systemic disease is concerned, is very suspicious of sinus disease. In the treat-

²⁷ Southern Medical Journal, November, 1918.

²⁸ Nebraska State Medical Journal, October, 1918.

²⁹ Iowa State Medical Journal, March, 1918.

³⁰ Laryngoscope, July, 1918.

³¹ Southern Medical Journal, November, 1918.

³² Annals of Otology, Rhinology and Laryngology, June, 1919, vol. xxviii, p. 452.

ment of sinus disease in children, Dean feels that removal of the tonsils and adenoids, if present, constitutes the first step. Puncture of the antrum of Highmore and lavage, or the Coffin treatment, is then carried out if necessary. It has been found that children suffering from sinus disease are much benefited by residence in a high, dry climate.

The radical disfiguring operations on the frontal and maxillary sinuses seem to have been less in favor during the temporary absence of German literature. More conservative measures are deservedly coming again into use. Citelli²³ (de Catane) reports excellent results by his method of treatment in both acute and chronic frontal sinusitis. This consists in making a 1 cm. incision through the soft parts, elevating the periosteum, and opening into the frontal sinus with a Collin's perforator, at the level of the supero-internal angle of the orbit. This small channel allows for both diagnosis and future treatment. Lavage through the opening can be done until the sinusitis subsides, the channel being maintained by a wick of gauze. On leaving out the wick, the fistula closes in a few days; a small punctiform scar, visible, but in no way disfiguring, remains.

For the treatment of maxillary sinusitis, an opening is made in the canine fossa and treatment applied through this as long as necessary. If a cure is not obtained in six months, a Caldwell-Luc operation is advised. It is probable that, with attention to the intranasal conditions, even these relatively slight external operations could be avoided in acute cases.

Multiple Osteoma of Nasal Accessory Sinuses. A case of multiple eburnated osteoma involving the frontals, ethmoid, right orbit, middle and superior turbinates and crista galli, and protruding into the cranial cavity is cited by Culbert.²⁴ As this osteoma was so large and involved so many sinuses, it was impossible to remove it as a whole, so that no exact size, shape, measurements, nor weight could be obtained; consequently, the size was determined as far as possible by measurements of the shadows in the roentgenograms. In the frontal sinuses and the right orbit, this osteoma was one solid, continuous growth; but in the ethmoid region, it was composed of several nuggets, some of whose faces articulated perfectly. They resembled the tight overlapping of peanuts in a shell. In the operation, the result of this articulation was that when a part of one face was bitten off, the combination was unlocked with liberation of the remainder of that portion. These peculiarities of growth seem proof to the author that this multiple osteoma had several foci, which were, possibly, the frontal sinus, the junction of the frontal and ethmoid, the ethmoid, and the turbinates, and that all these different simultaneous growths were finally jammed and molded together. This growth covered a period of at least ten years. Although at necropsy an abscess was found in each frontal lobe, no sign or symptom referable to them had presented during the patient's life, with the possible exception of the last few days.

²³ L'Oto-rhino-laryngologie internat., July, 1919, No. 7, p. 289.

²⁴ New York State Journal of Medicine, December, 1918.

Ozena. Caldera³⁵ after testing out *in vitro* the known antiputrefaction action of bile on the germs present in the secretion of ozena, made further applications of sterilized gauze impregnated with bovine bile or with a 3 per cent. solution of sodium taurocholate to the nose. He allowed these applications to remain in the nose from twelve minutes to one and one-half hours and states that his results were encouraging. Coffin³⁶ has found that the odor of ozena is sometimes due to retained secretions in the antrum or antra, and has cured some severe cases of ozena by the drainage of these cavities. It is the belief of Duverger³⁷ that ozena is a local trophic disease involving at first the nasal mucosa and later the underlying osseous framework, and depending directly upon the general health of the patient. Air is the physiologic stimulus to the function of the nasal mucosa and particularly to the secretory function. Cure, up to thirty years of age, is extremely easy; it suffices to reëducate their nasal respiratory function, first removing the crusts. It is necessary from the outset to prescribe lavage of the nose, and to utilize but light massage and nebulizations of mineral oil to remove the crusts. The patients lose during the night the benefit of nasal reëducation accomplished during the day. It is absolutely necessary to maintain nasal respiration at night as well as during the day. All ozena cases, when cured, remain cured if, having been improved in general health, respiration through the nose is carried out night and day. We should be happy to share in this optimistic view of ozena, but our experience has led us to believe the condition is much more difficult of cure.

The treatment of ozena by the "*Glycophilic Method*" has shown excellent results in the hands of Hayton.³⁸ The method consists in the frequent swabbing of the nasal chambers with a 25 per cent. solution of glucose in pure glycerin. At first five or six applications are made daily, the patients being taught to apply the medicament themselves. As the condition improves, the number of applications is diminished until one a day suffices. The stench, headaches and crusts are said to be eliminated by this treatment, and if too much structural atrophy has not occurred, permanent cure can be expected.

On the theory that ozena is due to the lack of the normal ciliary movements, which have been lost by some inflammatory process with the consequent destruction of the physiologic cleansing mechanism, Wittmaack³⁹ endeavored to remedy this by diverting the outlet of the parotid gland into the maxillary sinus so that the saliva passed from this sinus into the nose, thus lavage the nasal mucosa constantly. Following the operation, the ozena is said to subside without any other treatment. The operation begins with the Caldwell-Luc radical operation on the maxillary sinus, and, with bilateral ozena, this must be done on both sides. The interval since his first case has been eight months, and the cure has been complete and permanent. The drawback to the method

³⁵ Arch. Ital. di otol., 1916, vol. xxvi, fasc. 1, p. 1.

³⁶ Laryngoscope, December, 1918, vol. xxvii, p. 903.

³⁷ Rev. de laryngologie, 1918, No. 1, p. 1.

³⁸ Proceedings of the Royal Society of Medicine (Section on Laryngology), August, 1919, vol. xii, p. 227.

³⁹ Deutsch. med. Wchnschr., Berlin, January 16, 1919, vol. xiv, p. 70.

is that during chewing the flow of saliva is so profuse that some may drip from the nose. The patient has to choose between this and his ozena. All his five patients, however, have been more than satisfied with the outcome, especially as the secretion of saliva seems to grow less with time. It is improbable that this form of treatment will be widely practiced until a longer period of time has demonstrated the permanency of the cure.

Hay-fever. In a number of cases of hay-fever treated by Eves⁴⁰ good results have been obtained from pollen extract injections. He advises that each patient be carefully tested with a small amount of pollen extract to determine the pollens to which he is sensitive. If the patient is sensitive to more than one pollen, the extracts may be combined and given together for treatment. On no account should the patient be given the treatment unless he is known to be sensitive to the pollen extracts given.

The best results have been obtained by the prophylactic use of pollen extract. Beginning three or four weeks before the season with minute doses (1 c.c. of a 1 to 5,000,000 or 1 to 10,000,000 dilution) and gradually increasing the dose by $\frac{1}{4}$ to $\frac{1}{2}$ every three or four days until from ten to fifteen doses are taken. If an overdose is given, the patient may be thrown into a violent, acute attack of hay-fever with urticaria and exhaustion. These attacks usually come on about one hour after the dose is given, and last from one to three hours. Eves does not believe that true pollinosis is influenced by vaccines, although they may have a beneficial action on some focus of infection somewhere in the body that is causing rhinitis simulating hay-fever.

Nasal Deformities. In rib transplantation to correct nasal deformity Lee Cohen⁴¹ leaves periosteum and perichondrium on at least one side of the graft, generally that in contact with the skin. The placing of all nasal grafts, where the skin is intact, he does subcutaneously, the incisions being made within the vestibule, after the manner devised by the late John O. Roe. An important point in technic is the avoidance of handling the graft with anything except sterile forceps, and it is essential that the undersurface of the graft be in contact with bone which has been entirely freed of its periosteum.

CELLULOID IN CORRECTION OF NASAL DEFORMITIES. In spite of the frequent reports of bad results and the general condemnation of the use of foreign materials in the correction of nasal deformities, New⁴² after experimentation by the implantation in dogs of thin pieces of perforated celluloid, tried this method with apparently good results in 5 cases. In some the celluloid has been in place for more than a year. For the insertion of the implant he uses the technic described by the late Dr. Beckman. A curved incision extending down to the bone is made across the nose between the eyes where the bridge of a pair of glasses would rest; a pocket is made over the dorsum of the nose down to the tip with small, blunt, curved eye scissors. The piece of celluloid is trimmed and

⁴⁰ Pennsylvania Medical Journal, July, 1918.

⁴¹ Southern Medical Journal, March, 1919.

⁴² Journal of the American Medical Association, April 6, 1918.

moulded to the desired shape after placing it in hot water, and the wound is closed with horse hair and sealed with compound tincture of benzoin. The thin copper splint devised by Roe is then applied and held in place by adhesive plaster.

Hett⁴⁸ uses the middle and inferior turbinates and also the septum nasi to repair damage to the nose due to war injuries. The inferior turbinals especially have proved successful in wounds in the floor of the nose causing perforation through the palate. Advantage is taken of the fact that adhesion between the septum and turbinates readily form if there is an abrasion of their surfaces, and, owing to their vascularity, the vitality of the turbinals is great. In cases of the destruction of the alæ and turbinates, the anterior one-half of the opposite inferior turbinate has been used as a free graft attached anteriorly to the septum and posteriorly to the junction of the nasal floor and outer wall of the nose.

In case of loss of the upper part of the bridge of the nose, the middle turbinals are useful in filling up the hole and also, in combination with the septum, they can be made to form a support for the skin flap which covers over the gap. They have the added advantage that the mucous membrane of their deep side can be left, and thus form a mucous membrane lining as well as a support for the overlying skin flap. A turbinate may be first semi-detached and its posterior end made to form a new attachment, and subsequently its anterior end may be cut free and advanced to a new position. This was found useful in a case of destruction of the nasal process of the superior maxilla. In a case of perforating wound of the nose in which the external wound had closed, there was depression of the bridge with undue prominence of the tip, with nasal obstruction. Here a submucous resection was performed, and the cartilage removed was inserted beneath the skin to correct the depression. Heterogeneous septal grafts when the soft tissues of the septum remain intact are spoken of as a possibility, but no cases are cited. For bringing up the prominence of the bridge, two other methods are described. This is the method of the septal swing either upward, downward or laterally.

In the case of the upward swing, the septum is cut backward along the floor at the junction of the maxillary crest. The cut is then continued upward toward the roof of the nose, and the septal flap, including cartilage and mucous membrane, is swung forward, remaining attached by a pedicle above. It is retained in position by advancing the two turbinals so that a pent house supports the partition. This is useful for producing a prominence due to loss of tissue of the upper part of the bridge. The reverse of this is done for the lower septal swing and is useful in pug-nose.

The series of articles by Hett in the Proceedings of the Royal Society of Medicine (section of Laryngology) beginning in the June, 1919 number, on the methods of plastic restoration of wounds of the nose and accessory sinuses should be read "in extenso" by those interested in the work. Marvellous results have been obtained by the use of skin flaps of

⁴⁸ *Lancet*, London, 1917, vol. ii, p. 892.

special construction and by cartilage transplants. By excellent illustrations the work is visualized, and the description of the technic is most clear and interesting.

PARAFFIN INJECTIONS. In the microscopic study of tissue from the site of a paraffin injection in the nose, Wingrave⁴⁴ states that he found the paraffin to have penetrated indiscriminately between the muscle fibers and areolar tissue, compressing and distorting them so that their identity was often obscured, the individual muscle fibers being cloudy and their striations lost. These tracts and spaces were all lined with endothelium, either as a single layer or as swollen cells. At various points they were so massed as to suggest neoplastic activity. The changes were strictly endothelial and of conservative nature, notwithstanding the heteroplastic or "giant cell" tendency of some of the cells, for these cells showed no sign whatever of any tendency to caseation nor to be attended by lymphocytic deposit. The fact remains that paraffin, however stable or "indifferent" it may be, when in the tissues constitutes a foreign body, keeps the adjacent cells in a state of activity, and is consequently potential for harm. Changes in the contour of the site of injection show that the paraffin migrates, and this evidences also the fact that the tissues are not at rest. Islands of endothelium near the paraffin spaces histologically bear a close resemblance to mesotheliomatous formation, and are neoplastic "*in posse*." The tissue examined was removed by Dr. Dan McKenzie from the alæ and point of the nose of a young man who had received an injection of paraffin ten years previously for a deformed nose. The patient complained that in the winter time the "lump" gave rise to an intolerable feeling of cold and he was willing to undergo five operations for its removal. McKenzie emphasizes the difficulty encountered in removing this paraffin-infiltrated tissue. It was finally necessary to resect the whole cutaneous covering of the nose to dissect out the material.

Rhinophyma. Recent reports of cases of rhinophyma treated by decortication of the nose are made by New⁴⁵ and Fuld.⁴⁶ The latter believes his excellent results to have been due to skin grafting of the denuded surface, while New following the methods of Keen, White, and Heinick, allowed the wound to epithelialize without grafting, the epithelium springing from the lining of the glands of the nose. Heidingsfeld⁴⁷ reports a cure of a case of rhinophyma by the use of radium. A total of 18 applications was made at intervals of two or three weeks. The growth was of the size of a walnut perched prominently on the dorsal aspect of the nose.

PHARYNX AND MOUTH.

Non-surgical Treatment of Diseased Tonsils. An evidence of a backward swing of the pendulum of enthusiasm in surgery of the tonsil is a discussion of the non-surgical treatment of enlarged or diseased tonsils

⁴⁴ Journal of Laryngology, London, November, 1918, vol. xxxiii, p. 330.

⁴⁵ Laryngoscope, July 19, 1919, vol. xxix, p. 391.

⁴⁶ Journal of the American Medical Association, June 14, 1919, vol. lxxii, p. 1734.

⁴⁷ Journal of Cutaneous Diseases, May, 1918, p. 314.

by Moore⁴⁸ in which he brings forward the chemical destruction of the tonsillar mass by the London paste of Morell Mackenzie. The paste is a mixture of equal parts of caustic soda and unslaked lime, moistened at the time of using with absolute alcohol. Moore has devised a special saucer-shaped applicator which he states will obviate the danger of a portion of the paste falling into the larynx or being swallowed. It is probable that the electrical non-operative measures would find more sympathy in this country, and that, in those cases in which operation is deemed dangerous, the roentgen-ray exposure will be used more extensively. Excellent results have been reported in the reduction of size of enlarged tonsils and the relief of absorptive symptoms from diseased tonsils with roentgen-ray treatment by Stewart,⁴⁹ and others.

Focal Infection of the Tonsils and Teeth. We are entirely in accord with Alvarez⁵⁰ in his protest against the reckless extraction of teeth. In their enthusiasm in the theory of focal infection physicians have advised the wholesale extraction of, in some cases, perfectly sound teeth, with no regard or thought of how the patient would, in the future, masticate his food, nor of the disturbance of digestion and nutrition which would develop because of the imperfect mastication. The miraculous cures reported are often but temporary, and the toothless patient again begins his rounds of doctors' offices. It seems to be the method of some physicians to pull the teeth first, and, if the condition of which the patient complains does not disappear, then look further for the cause of the trouble. Alvarez makes a plea for a thorough physical examination and careful study of the patient before the advice of extensive tooth extraction is given and most wisely states that we should be more careful what we promise in return for a toothless mouth.

The part played by alveolar abscesses as the cause of certain conditions must, however, not be overlooked: "but in view of the fact that the most thorough removal of focal infections often fails to cure arthritis and other diseases, let us be more honest and conservative with our patients. Let us be careful what we promise them. Let us save serviceable teeth whenever possible. Above all, let us do unto our patients only what we would have done unto ourselves if their teeth were in our heads."

A careful search might reveal a focus of infection in the accessory sinuses, ear or tonsils, but the same cautious elimination of other sources should obtain. It is quite as unscientific to advise the removal of tonsils which are not obviously diseased as a preliminary measure and to then look for a further source of disease when the patient fails to find the promised relief.

The outcome in 30 cases in which tonsillectomy was done to ward off recurring polyarticular rheumatism or hemorrhagic nephritis is given by Nordlund.⁵¹ The effect was realized in nearly every case, a large

⁴⁸ *Journal of Laryngology, Rhinology and Otology*, London, October, 1919, vol. xxxiv, p. 387.

⁴⁹ *British Medical Journal*, 1913, vol. i, p. 1157.

⁵⁰ *Journal of the American Medical Association*, 1919, No. 16, vol. lxxiii, p. 1179.

⁵¹ *Hygiea*, Stockholm, 1919, vol. lxxxi, p. 497.

number having been free from recurrence since the operation. The results seem to have been equally favorable whether tonsillectomy was done during an acute attack or during an interval. The benefit was striking also in 12 cases in which hemorrhagic nephritis had followed an infectious sore-throat.

The lack of *preoperative study* of patients is much deplored by Oppenheimer and Gottlieb²² who rightly state that much mortality and morbidity could be avoided if more attention were paid to the general state of the patient. The determination of any tendency toward postoperative bleeding should be made by careful history and the estimation of the coagulation time and bleeding time of the patient. The coagulation time is determined by puncturing the skin and drawing blood into a 0.2 c.c. pipette, incubating in a thermostat at 37° C., and examining for coagulation a drop blown from the pipette onto a glass slide at intervals of two minutes. In an examination of over 400 cases by this method, the average clotting time was found to be 6.3 minutes, the longest time twenty-nine minutes, the shortest, one and a half minutes. Bleeding time was estimated by pricking the skin and observing how long it will bleed by gently squeezing the part from time to time. In nearly 200 cases the average bleeding time was found to be five minutes; the longest, twenty-nine minutes, and the shortest bleeding time two minutes. It was found that the coagulation time may be prolonged and the bleeding time shortened, or *vice versa*, or both may be prolonged. In anaphylactic conditions, such as asthma, it was observed that the coagulation time is prolonged. It is also interesting to note that this same altered blood coagulability was present in the children of individuals who have an anaphylaxis, although the children themselves manifest no symptoms of asthma or pollinosis.

Complications of Tonsil and Adenoid Operations. Baum²³ in the midst of new and modified tonsillar operations recalls to mind some of the complications and sequelæ of the operation. *Hemorrhage* of hemophilic origin should be prevented by careful family history and the taking of the coagulation time, and treated by the use of blood serum and by blood transfusion. Simple hemorrhage should be controlled by suture ligature or pressure. The use of hemostatics is condemned, especially that of hydrogen peroxide. A clot should never be left in a bleeding fossa. All of the patients require hospital care.

Accidents from anesthesia are best avoided by having a trained anesthetist. The author prefers warm ether for general anesthesia and apothesine or novocaine for local anesthesia. Deaths from so-called status lymphaticus have been in some cases due to tracheal pressure resulting from an enlarged thymus. Suffocation may result from the aspiration of blood, tissue, or the foam produced by the use of hydrogen peroxide. Good suction and lowering of the head should free the pharynx of accumulation.

Acidosis following the operation is occasionally seen; a preliminary urinalysis, and, similarly, a postoperative urinalysis will give the diag-

²² Laryngoscope, July, 1919, vol. xxix, p. 400.

²³ Annals of Otology, Rhinology and Laryngology, March, 1919, vol. xxviii, p. 37.

nosis. The treatment, both preventive and active, consists in the administration of sodium bicarbonate by mouth or bowel, and the use of glucose by mouth, bowel or intravenously.

Pain following tonsillectomy can be relieved by a local application of a mixture of cocaine, menthol and phenol of each gr. xv to the ounce of alcohol. The soreness is not relieved by anything but anodynes.

Sepsis. Peritonsillitis and suppurative cervical adenitis have followed tonsillectomy; in Baum's experience they have occurred in cases operated upon under local anesthesia and are explained by carrying of the infection present in the tonsil into the deeper tissue by deep injections of the anesthetic. General septicemia and death have been reported, and acute articular rheumatism and endocarditis have followed. Numerous cases of pulmonary abscess are reported following tonsillectomy. They may result from the inspiration of septic material, blood or tissue, or, as Richardson⁴⁴ suggests, the septic material may reach the lung by way of the lymphatic or venous channels, particularly the latter. Pulmonary infarct has been reported. Pneumonia following tonsillectomy has been a frequently reported complication and occurs even in cases where local anesthesia was used.

Foreign bodies aspirated during tonsillectomy have been reported. Loose teeth in children have been wedged out by the mouth gag and aspirated.

Otitis media is probably due to lowered resistance and the presence of infection. Mastoiditis has resulted.

Lymphoid hyperplasia has occurred in spite of skilful surgery. This is readily accounted for by the finding of extracapsular lymph follicles.

Deformities. Badly damaged pillars, torn palate, uvulectomy, etc., may not result seriously to the speaking voice in all cases but are fatal to the singing voice. Excessive scar formation is likely to follow operations on syphilitics. Much damage has been done with the adenotome by removing the Eustachian eminences and by excessive scar formation following its too vigorous use. Secondary tubal trouble is prone to follow the scar contraction.

Neuralgia and dryness of the pharynx subsequent to the healing of the tonsillectomy wound may be the result of an incision in the scar of terminal filaments of the glossopharyngeal nerve as shown by Matthews.⁴⁵

Peritonsillar Abscess. The possible serious results from delayed evacuation of a peritonsillar abscess are illustrated in the report by Wylie⁴⁶ of a woman who, five days after the diagnosis of a peritonsillar abscess, developed swelling of the eyeball and pain in the head. No treatment was had until eleven days later, when the patient complained of pain in the cervical region, fever, impaired speech, and prominence of the left eyeball with ptosis. Free evacuation of a peritonsillar abscess of sixteen days' duration was now done. No previous incision had been made, neither had the abscess opened spontaneously. Death occurred twenty-five days after the inception of the symptoms. Postmortem

⁴⁴ *Annals of Otolaryngology and Laryngology*, December, 1917.

⁴⁵ *Journal of the American Medical Association*, February 12, 1916.

⁴⁶ *Lancet*, February 1, 1919.

examination showed that the pus had travelled backward into the pre-vertebral space and there existed an osteomyelitis with extensive destruction of the basocranial bones. The bones showed necrosing encephalitis and the ventricles were filled with thick, green pus. The pituitary body was reduced to a semi-fluid mass. The jugular bulb, sigmoid, and lateral sinuses were firmly thrombosed. Smears from the pus of all the regions showed the same character, *viz.*, streptococci, staphylococci, mycelia, and coarse forms of *spirocheta fetida*, with some bacilli of xerosis type (diphtheroid). The right orbit contained pus which entered by a perforation in the ethmoid.

SPLenic INFARCT FOLLOWING PERITONSILLAR PHLEGMON. Calders⁵⁷ reports a case in which the opening of a peritonsillar abscess was followed by a hemorrhage lasting four or five hours, the proportions of which, however, were not serious. There was no question of hemophilia. A large hematoma involving one-half of the soft palate and one side of the pharynx developed; at the same time the patient complained of pain in the splenic region. The edge of the spleen could be felt extending about two fingers beyond the costal margin. The resorption of the hematoma occurred in about forty-eight hours; the pain in the splenic region disappeared in about thirty-six hours and the enlargement of the spleen subsided in ten days. All of these conditions passed without rise in temperature. This case is instructive from the point of view of septic conditions complicating disease of, or operations on, the tonsils. It renders easy the explanation of lung abscesses which have followed even the most careful tonsillectomies, done by skilful throat surgeons. The hematogenous route is here unquestionably established.

Bacteriology of the Tonsillar Crypts. It has been the finding of most investigators that the tonsillar crypts are excellent incubators for the various forms of streptococci, of which the streptococcus hemolyticus and the streptococcus viridans are the most commonly found. A Gram-negative diplococcus is also frequently found and may have great pathological significance not at present known. In a study of hemolytic streptococcus carriers, Nicholas and Bryan⁵⁸ found that cultures of nasal swabs were either negative or showed but few colonies of hemolytic streptococci; the pharynx cultures were moderately positive; those of the saliva were slightly so, but the tonsil cultures showed in every case a rich growth of the hemolytic streptococci. Out of 25 cases of typical acute tonsillitis, only one failed to show a rich culture of hemolytic streptococci. The crypts of 75 pairs of excised tonsils out of a total of 100 examined, showed the presence of the hemolytic streptococci. An attempt was made to sterilize the crypts of some streptococcus carriers by the application daily into the crypts of a 25 per cent. silver nitrate solution. It was found that in a few cases with open crypts, the silver nitrate treatment was effective; but in most tonsils it was found impossible to sterilize the crypts by this means and excision of the tonsil was decided upon as the only sure protection of the individual and others from

⁵⁷ Bull. della Malattie dell 'Orechio, June, 1917, p. 85.

⁵⁸ Journal of the American Medical Association, November 30, 1918.

the infection. MacLay⁵⁹ in a study of 268 cases found that the incidence of the streptococcus hemolyticus and viridans was relatively much greater in the autumn than in the summer months, although he found a surprisingly small number of cases gave positive cultures for these organisms.

Hare-lip and Cleft Palate Operative Treatment. Nicoll⁶⁰ believes these should be done early for three reasons: (1) The earlier the age, the less the shock. Psychic or mental shock (the result of fear) is entirely absent in early infancy. (2) The earlier the age the more pliable and malleable the tissues. (3) In cases of marked cleft palate it is often the case that a child born well nourished, steadily emaciates from starvation owing to faulty deglutition. In hare-lip complicated by cleft palate, all operations in the way of paring, moulding, and wiring the malleable osseous tissues should be carried to completion of union before the soft tissues are treated, this for the reason that increase of blood supply to the soft parts occurs after closure of the bony cleft. Nicoll has never seen nasal obstruction and rarely imperfect alignment of the teeth result from Brophy's operation of approximating the partially ossified maxilla with silver wires. When malocclusion does occur it should be treated by an orthodontist and not by extraction of the teeth. Coöperation of the surgeon and the dentist is required as the patients develop.

LARYNX.

War Injuries of Larynx. Harmer⁶¹ analyzes 245 cases. He calls special attention to the frequency of paralysis of the vocal cords after gunshot wounds of the neck. Appearing immediately after the wound, it is generally abductor in type in the early stages. There is little doubt in Harmer's mind that shock is chiefly responsible, for the following reasons: (1) The large number of cases reported. (2) Paralysis of other cervical nerves (excluding brachial plexus) are comparatively rare. (3) Other nerves are known to be paralyzed by shock. (4) Paralysis of the recurrent has occurred several times after ligature of carotid aneurysms, and is well known in many other operations of the neck. (5) Paralysis of the brachial plexus is common after wounds of the neck, and all its trunks are generally involved rather than one, as would occur if a direct injury were responsible. The mortality from wounds of the larynx is high.

In 512 cases of neck wounds, mostly treated in France, there were 31 deaths, 2 of which had received injuries to the larynx. On the other hand, 1873 neck wounds were treated in English hospitals during the same period with only 17 deaths. Of these, 110 received injuries to the larynx and only 1 case ended fatally. These figures prove that the mortality is much greater at the front than at the base. In two-thirds of the gunshot injuries of the larynx that survive for more than a week

⁵⁹ Laryngoscope, August, 1918.

⁶⁰ Annals of Surgery, January, 1919, vol. lxxix, p. 12.

⁶¹ Journal of Laryngology, Rhinology and Otolaryngology, London, January, 1919, vol. xxxiv, No. 1.

recovery is complete, and no ill effects are produced beyond alteration of the voice.

"Pneumococcus Ulcerative Laryngitis." A new ulcerative disease of the larynx is reported by Owsley⁶² as observed by him in Camp Travis, San Antonio, Texas. The symptoms are hoarseness or aphonia and sometimes paroxysmal coughing. The aphonia in some cases was very persistent. The laryngeal mirror examination showed usually symmetrically opposed patches of ulceration on the superior surfaces of the cords, involving their free borders, and seem to be limited to the anterior third of the larynx. The situation of the ulceration serves to differentiate the conditions from tuberculosis of the larynx. The pneumococcus was the constant and predominating organism found in 40 laryngeal smears, and it is thought that the instability of the temperature in the Texas climate was a predisposing factor in addition to the lowered vitality following debilitating diseases. The treatment found most effective was the laryngeal application of from 2 to 5 per cent. silver nitrate solution, done every other day. For the aphonia, electric stimulation by means of the interrupted faradic current gave the best results. It is interesting that in a few cases paralysis of the arytenoideus transversalis persisted long after the other muscles had regained their tone. This leaves the triangular space between the arytenoids open and causes aphonia. All of the cases, however, recovered completely.

Influenza Complications. In 6870 cases of influenza observed by Hill⁶³ at U. S. A. General Hospital, No. 14, during the recent epidemic there were 16 cases of acute laryngitis, which consisted of a diffuse, inflammatory process involving the false cords and epiglottis, with varying degrees of swelling and redness of the true cords and consequent limitation of motion. In some cases it was quite impossible to see the cords. Two cases showed hemorrhagic vesicles of the true cords. These were unilateral and situated about the junction of the anterior and middle third. Later, these ruptured and gave the appearance of superficial ulceration about 3 mm. in diameter which healed with treatment in about ten to twelve days.

The reviewer, during the recent epidemic, saw 3 cases of acute edema of the larynx complicating influenza. In one, intubation tided the patient over until the edema subsided. The other 2 required tracheotomy and it was three months before the cannulæ could be removed. E. D. Smith⁶⁴ reports a case of influenza laryngeal edema in which he performed tracheotomy, from which the patient made an uneventful recovery. Three previous cases exhibiting similar symptoms to the patient operated upon, had died in the same institution.

Mackey, Blakeslee and Price⁶⁵ cite the interesting fact that edema of the glottis complicating influenza from which the decedent died on March 28, 1918, was an infection that did not naturally result from a

⁶² *Annals of Otology, Rhinology and Laryngology*, September, 1918, vol. xxvii, p. 874.

⁶³ *Laryngoscope*, June, 1919, No. 6, vol. xxix, p. 353.

⁶⁴ *Kentucky Medical Journal*, July, 1919.

⁶⁵ *Medicolegal Aspects of the Workmen's Compensation Law of Pennsylvania*, Harrisburg, Pa., 1918, p. 46.

violence to his body which had occurred on September 11, 1916, and that therefore his heirs were not entitled to compensation. The more interesting statement is made in the history, which shows that for five days preceding his death he had had an edematous laryngitis with marked shortness of breath. Death from edema of the glottis, unless it be of fulminating character, is entirely preventable by tracheotomy. This brings up the question as to how many other similar cases during the recent epidemic have died whose lives might have been saved by timely tracheotomy.

Hoarseness. McCready⁶⁶ has emphasized that hoarseness is often a symptom of serious local or general disease. The general practitioner is apt to regard hoarseness lightly and must be warned by the laryngologist of the seriousness of the symptom. We as laryngologists should bear in mind the following: Always give a guarded prognosis, and impress on yourself and the patient the importance of an early diagnosis. Laryngeal examination in children is easily accomplished without anesthesia by means of the direct laryngoscope. An enlarged thymus may cause hoarseness and dyspnea in the young. The assistance of the internist and neurologist is of the greatest value in some of these cases. Remember especially that hoarseness many times is the danger signal in diseases of the central nervous system, lungs, mediastinum, heart with adjacent large vessels, and think of the serious complications that develop from procrastination.

Laryngeal Tuberculosis. A most hopeful view of the cure of laryngeal tuberculosis is offered by Rebuck⁶⁷ in his analysis of the many cases seen by him in the Mt. Alto State Tuberculosis Sanatorium. In the treatment of the condition, he advocates the correction of defective nasal breathing, removal of diseased tonsils, and regular treatment of any existing chronic pharyngitis. An alkaline nasal wash and bland oil spray is ordered so that the nose and nasopharynx may be kept in a healthy condition. As a laryngeal application, 5 per cent. formalin in glycerin he finds gives the best results when applied thrice weekly. To relieve the pain resulting therefrom, a free application of an orthoform emulsion is made the formula of which is given:

Menthol	40 grams
Oil of sweet almonds	6 drams
Yolk of egg	4 "
Orthoform	2 "
Distilled water	q. s. 2 "

Lozenges containing gr. $\frac{1}{10}$ to $\frac{1}{4}$ cocaine or a lozenge made after the following formula may also be used for the relief of pain and odynophagia:

Dionine	$\frac{1}{10}$ grain
Hyoscyne	$\frac{1}{100}$ "
Menthol	$\frac{1}{10}$ "
Red gum to make a lozenge.	

⁶⁶ Pennsylvania Medical Journal, May, 1918.

⁶⁷ Pennsylvania Medical Journal, September, 1918.

Those suffering great pain are treated by twice weekly injection of the superior laryngeal nerve with a mixture of 1 per cent. cocaine, 25 per cent. water and 75 per cent. alcohol.

Twedell⁶⁸ claims that sulphur dioxide inhalations have a beneficial influence in all cases of tuberculosis in which the gas can come in contact with the diseased tissues, as in tuberculosis of the lungs, larynx, ear and nose. The treatment is well worth further trial.

Dworetzky⁶⁹ finds that a spray of 5 per cent. menthol in olive oil gives relief in laryngeal irritation and tickling, etc. For topical applications, iodine in glycerin gives him the best results. The strengths vary from $7\frac{1}{2}$ grains and double the number of grains of potassium iodide in 1 ounce of glycerin to $37\frac{1}{2}$ grains with the same proportion of potassium iodide to the ounce of glycerin. Iodine is said to have a special affinity for tuberculous tissue, and is penetrating and antiseptic in its action. The fallacy of treating the larynx and disregarding the lung condition again receives emphasis, for the laryngeal lesion is secondary to the lung condition.

Lukens⁷⁰ found laryngeal involvement in 4 per cent. of 500 cases of pulmonary tuberculosis examined by him. Both Lukens and Dworetzky bring out the marked therapeutic action of absolute vocal rest on active tuberculosis of the larynx. Lukens urges the blocking of the internal branch of the superior laryngeal as the best method of relieving the odynophagia and uses a solution of novocain, 2 grains; chloroform, 10 minims; alcohol, 6 drams; water, 2 drams—essentially a 65 per cent. solution of alcohol. In 18 cases bilateral injections were made and no untoward effect was observed.

Lockard,⁷¹ in a series of 400 cases, had not a single mortality from amputation of the epiglottis, even though some of the patients were extremely ill. He is enthusiastic over the relief from odynophagia afforded to those patients in whom there was epiglottic involvement and advocates the removal of the whole or a part of the organ whenever other remedies fail to control the pain. Even if the removal of all of the involved tissue be not done, the stump often recedes to normal size and it is rare to find any recurrence in the stump. The chief indication for the operation is the relief of painful swallowing, which once relieved allows forced nutrition and thus has an indirectly beneficial action on the lung condition. Lockard states that a number of patients in whom the operation was done as a purely palliative procedure from ten to twelve years ago, so unexpectedly improved that the disease was eventually arrested. The only contra-indication found was in that form of epiglottic involvement, either infiltrative or ulcerative, in which the base of the tongue or the pharyngo-epiglottic folds share in the process. Fatal progression is in these cases so rapid that operation offers no prospect of either arrest or palliation.

Acromegaly of the Larynx. Four cases of acromegaly of the larynx are reported by Jackson⁷² in which external examination showed the

⁶⁸ Medical Record, December 21, 1918.

⁶⁹ Long Island Medical Journal, May, 1918.

⁷⁰ New York Medical Journal, February 28, 1918.

⁷¹ Colorado Medical Journal, April, 1918.

⁷² Journal of the American Medical Association, November 30, 1918.

larynx to be of enormous size, the enlargement seeming even and symmetrical. Laryngoscopic examination showed a general overgrowth of the larynx; the epiglottis, aryepiglottic folds, ventricular bands and vocal cords being proportionately enlarged. The whole laryngeal image was strongly suggestive of the facies and "ginger bread hands" of acromegaly. In one of the cases the overgrowth of the larynx led to the diagnosis of acromegaly by the internist at a later date. Acromegalic changes in the larynx may produce stenosis sufficient to require tracheotomy to prevent asphyxia, dyspnea being added to by impairment of the glottic movements, resulting in a defective bechic cycle. The altered voice in acromegaly may be due to laryngeal changes as well as to alteration in the resonating cavities, lingual enlargement, etc.

Cartilaginous and Amyloid Tumors of the Larynx and Trachea. New⁷³ believes that in the classification of cartilaginous tumors of the larynx, only 38 cases of which have been reported in literature, the terminology should designate whether the tumor is benign or malignant. A chondromyxoma may be benign or malignant, but the name would not indicate this fact. He reports an interesting case of chondroma of the thyroid and cricoid cartilages. In a later paper, New⁷⁴ reports 4 cases of amyloid tumor of the larynx and reviews the literature on the subject most thoroughly. His 4 cases occurred in women between the ages of thirty-six and fifty-six. They were treated with radium, fulguration and excision, and there seemed slight tendency to recurrence. With the 4 reported, the total number of cases reported in the literature is said to be 47.

Nodular Laryngitis. Pognat⁷⁵ states that laryngeal nodules in the adult do not appreciably affect the speaking voice, but in children the voice becomes raucous. In adults, the adduction of the cords is complete; in children, on the contrary there persist during phonation two median openings, the one in front and the other behind the approximated nodules. This difference in the position of the cords in adults and children is due to the fact that in children there occurs a false sensation of complete adduction at the moment the opposing nodules come in contact. This sensation results in an inhibition of the adductor muscles, which, therefore, fail to completely approximate the cords. The adult, more trained, is not deceived, and in spite of the approximation of the nodules completes the adduction. Phonation is therefore normal.

In children, as a result of this error of perception, there develops a functional habit which fixes and aggravates the raucity.

The author recommends as a mode of treatment, vocal exercises with the aid of the galvanic current. The added stimulus completes the act of adduction and further combats any secondary paresis of the adductors. This treatment has given him remarkable results.

⁷³ *Laryngoscope*, May, 1918.

⁷⁵ *Rev. de laryngol.*, 1918, No. 8, p. 179.

⁷⁴ *Ibid.*, June, 1919.

TRACHEA.

Recurrent Teratomatous Growth of Trachea. Tracheal growths are exceedingly uncommon, and one reported by Freudenthal⁷⁶ is of unusual interest. A tailor, aged twenty-seven years, had been tracheotomized in Russia for diphtheria when he was fourteen years old. Following the operation he was quite well for five years. He then developed dyspnea, made worse by exertion. His voice was clear. Examination revealed, about an inch below the glottis, a web-like, grayish looking mass, that occluded the greater part of the trachea, leaving only a small opening anterior. Under suspension laryngoscopy, the mass, which under mirror inspection looked like a thin, grayish membrane, appeared reddish and of some dimensions. The patient, refusing operation without a general anesthetic, returned a few days later. On being anesthetized, deep cyanosis occurred and dyspnea became so urgent that a hurried tracheotomy was done. The mass was then removed and the base cauterized. Uneventful convalescence followed.

A year later he returned with the same condition, and again all visible growth was removed under suspension with general anesthesia. Nine months later he again presented. Under rectal anesthesia an effort was made to extirpate all of the intratracheal mass with the aid of a straight tube. Hemorrhage necessitated stopping the operation when but little of the growth had been taken out. A few days later, under rectal anesthesia, the trachea was opened and great masses of granulation tissue were removed with very little hemorrhage. The pathologist reported the growth to be an endothelioma. Radium, used for twenty-four hours, seemed to have a very good effect, and the wound healed kindly. A short time afterward recurrence was noted and tracheal stenosis became marked. With the aid of intratracheal anesthesia the trachea was again opened and the tumor with two tracheal rings resected, leaving the party wall intact. Healing again was uneventful and there was no trouble for several years. The tracheoscopic picture is said to have been most interesting. Below the glottis there appeared what might have been mistaken on superficial examination for another glottis. About an inch below the glottis on the left side, there was a whitish mass reaching almost to the center of the lumen of the trachea which looked very much like a vocal cord. On the right side there was a smaller one somewhat congested and also immobile. On deep inspiration, when nothing was seen of the true cords, these neoplasms could easily be mistaken for them.

After attempts to stretch the stenosis by long intubation tubes and bougies, it became imperative to operate again. This was done, but the patient died soon afterward from a hemorrhage. Microscopic examination of the tissues showed the tumor to be a myxochondrocyllindroma (endothelioma).

Fibroma of the Trachea. A boy, aged nine years, who had previously been in excellent health until three months before, at which time he

⁷⁶ New York Medical Journal, October 5, 1918.

had measles, consulted Horgan⁷⁷ because of irregular attacks of dyspnea of increasing severity. When first seen he was unable to walk unsupported, his face was livid and anxious, and his voice was feeble but clear, pulse was accelerated but feeble, there was orthopnea and inspiratory stridor. The lower sternal and costal cartilages, as well as the upper abdominal parietes and suprasternal notch, were in a state of permanent and decided retraction.

No breath sounds could be heard with the stethoscope in either lung, but a loud vibratory sound was audible over the central sternal region. Examination of the trachea carried out by the Avellis procedure revealed a dusky red globular tumor situated low down in the trachea. A low tracheotomy was performed under local anesthesia but the longest tracheotomy tube available failed to pass the tumor mass. The tracheotomy tube was removed and, holding the tracheal rings apart with a small self-retaining mastoid retractor, Horgan inserted a small Luc's nasal forceps in the direction of the bifurcation, grasping and removing a hard pedunculated tumor. Breathing at once became easy and recovery was uneventful. The specimen proved to be a fibroma and consisted chiefly of fibrous tissue and bloodvessels covered by compound epithelium. This is the thirtieth case of fibroma of the trachea recorded.

Laryngotracheal Stenosis from Yperite Gas. The serious and delayed damage to the air passages caused by the exposure to the war gases is well typified in a report by Lannois and Sargnon⁷⁸ of the case of a young artilleryman who, following exposure to gas, developed an ulcerative laryngo-tracheo-bronchitis. With the healing of the ulcerations, increasing dyspnea developed, necessitating tracheotomy. Lower bronchoscopy showed the trachea ulcerated in places, filled with large amounts of purulent material and extremely stenosed from the level of the larynx to the carina. Because of the small size of the bronchial orifices, it was impossible to enter the bronchi and attempts to dilate the trachea were unsuccessful. There was no evidence of lues in the patient or in his parents, and he had previously been in excellent health. There was no history of tuberculosis in the patient or his family; it was, however, feared that tuberculous infection would develop because of the lowered resistance of the parts and the poor condition of the patient.

In the same article, a case of Jacod's is cited in which a young soldier exposed to yperite gas on July 31, 1918, developed a progressive subglottic stenosis and a purulent edematous tracheobronchitis. Tracheotomy was done without relief, and the patient died on October 17, 1918, from bronchopneumonia.

The reviewer has seen many cases in which the laryngotracheal inflammation following exposure to war gases has persisted for periods of months, the larynx and trachea showing beefy red and in some cases with patches of exudate on the tracheal walls. The question arises as to how much the chronicity of the lesion is the result of improper drainage of the lower air passages in consequence of the destruction of the ciliated epithelium.

⁷⁷ British Medical Journal, December 14, 1918, p. 653.

⁷⁸ Rev. de laryng., d'otol. et rhinol., August, 1919, No. 16, p. 409.

Tracheal Cartilage Transplant. Hett⁷⁹ treated and cured a tracheal stenosis caused by wound contraction and want of support of the anterior tracheal wall, by covering the deficiency with a portion of the trachea of a dog. The wound healed after slight suppuration and the patient did well. The patient died suddenly four months later from a strangulated diaphragmatic hernia. Autopsy showed that the graft had persisted and had formed an ideal support for the anterior tracheal wall. Microscopic sections showed small islands of cartilage which seemed practically normal, except that there was some fibrillation of the matrix.

In an ingenious manner, Iglauer⁸⁰ has cured some 5 cases of laryngeal stenosis. By passing a cord through the tracheotomy wound into the mouth and drawing into the strictured area a doubled rubber tube, dilatation was obtained. A cord attached to the lower end of the rubber tube to the tracheotomy cannula and the cord through the mouth was allowed to remain for purposes of removal of the rubber tube. After sufficient dilatation was obtained, an intubation tube was inserted through the mouth aided by traction afforded by inserting a cord through two holes made in the lower end of the intubation tube. By the traction method it is possible to intubate some of these cases which ordinarily would prove very difficult, if not impossible. The tracheotomy cannula is left *in situ* and the intubation tube approximates it as closely as possible, being held by cord to the tracheotomy tube. It has been the experience of the reviewer that in using separable tubes as described above, in the interval between the two parts a spur persists which is very difficulty to overcome.

Prolonged Intubation. Emil Mayer⁸¹ reports the case of a boy, aged nine years, who had had diphtheria at the age of two, for which tracheotomy was done, resulting in a tracheal fistula for which he was admitted to the hospital. Attempts at plastic closure of the fistula failed, and dyspnea required reinsertion of the tracheotomy tube. Stenosis of the larynx followed, which was treated by divulsion with subsequent introduction of an intubation tube. This tube had to be removed under suspension and promptly reinserted at intervals for a period of five years, always under general anesthesia. Finally, the patient was able to be extubated, increase in size of the larynx and trachea coincident with the growth of the other organs being a factor in the cure.

BRONCHI.

The Endobronchial Treatment of Bronchiectasis. After a preliminary hypodermic of one-half a grain of morphine with atropine, and a cocaineization of the mouth, tongue, pharynx, larynx and bronchi, Mayer⁸² introduces a tube into the bronchus. This particular apparatus consists of a double tube, the outer one attached to a suction apparatus, the inner to an irrigating apparatus. The excessive secretion in the bronchi

⁷⁹ Proceedings of the Royal Society of Medicine, Laryngology Section, February, 1919.

⁸⁰ Annals of Otology, Rhinology and Laryngology, 1918, vol. xxviii, p. 1233.

⁸¹ Transactions of the American Laryngological Association, 1918.

⁸² New York Medical Journal, October 19, 1918.

is then aspirated, and 10 ounces of warm salt water slowly introduced through the inner tube is at once withdrawn through the outer one. At subsequent treatments a solution of iodine 2 drams, carbolic acid 15 minims, to 1 pint of water is used in place of the salt water. Dichloramin-T in the form of chlorazene was tried in a few selected cases. At first the treatments were given twice weekly, but because of the probability of the treatment continuing for months or years and the danger of forming drug habits, weekly treatments were preferred.

The benefits derived were an almost complete cessation of odor, a diminution in the amount secreted—at least, easier expectoration, and a decided improvement in the physical condition.

Bronchoscopic drainage has frequently been of benefit in these distressing cases. Meltzer demonstrated conclusively the tolerance of the bronchi to non-irritating solutions. In some cases broncholitis have been demonstrated and perhaps during the course of the treatment a foreign body may be found to be causing the trouble. If no other benefit were derived than the cessation of odor and the lessening of the septic symptoms, the treatment would be warranted.

Bronchiectasis and Syphilis. It is the opinion of Castex and Romano⁸³ that bronchiectasis in children and young adults is usually due to inherited syphilis and that secondary tuberculosis frequently becomes implanted upon it. Asthma in children and youths is thought also to be a result of syphilis. A lack of balance in the endocrine glands was apparent in all of the cases studied. Mercury seemed to materially benefit all the cases, while iodides and arsenic were useful adjuvants at times. The diagnosis should be made without delay so that specific treatment can arrest the mischief before irreparable damage has been done.

Insufflation of Opaque Substances into the Bronchi of the Living. Intra-bronchial insufflation of dry bismuth subcarbonate through the bronchoscope, has been found by Jackson⁸⁴ to have been of considerable value in mapping out the bronchial tree in cases in which a foreign body is far in the upper lobe bronchus or in small bronchi that cannot be entered by the bronchoscope. No untoward symptoms were observed, and the bismuth totally disappeared from the lungs by expectoration in twenty-four hours. The method is available in an enormous field for investigation of the action of the living cilia, in health and disease, the lymphatic drainage of the lung, and the mapping out of bronchiectatic and abscess cavities.

Asthma. The explanation of the asthmatic crisis as a spasm of the muscles of the bronchioli, with a consequent constriction of their lumen traceable to the vagus nerve, is not accepted by Freudenthal.⁸⁵ While he is not able to prove that this view is not correct, he believes that an attack is brought about not by spasm of the constrictor fibers coming from the vagus, but rather by a paralysis of the dilator fibers. The

⁸³ Prensa médica argentina, Buenos Aires, 1919, vol. v, p. 285.

⁸⁴ Transactions of the American Laryngology, Rhinology and Otology Society, 1918, p. 222.

⁸⁵ Laryngoscope, November, 1918, vol. xxvii, p. 781.

unusual occurrence of a spasm lasting for such a long time, as it often does in bronchial asthma, would seem to favor his view that, in so-called spasmodic or bronchial asthma, one is dealing with an atony or paresis or paralysis of the bronchodilators, and not with the spasm of the constrictors. The sympathetic system is also of great importance in this connection. The ramifications from one system to the other are numerous, and there may be no disturbance of the sympathetic when the symptoms incline toward an irritation of the vagus, and *vice versa*. While the action of these nerves is not clearly established, other symptoms favor his theory. For example, the abdominal muscles that are concerned in expiration are quite flaccid even during expiration, which could not happen if a spasm of the expiratory muscles had been present. Another point in favor of the theory is the frequent development of pulmonary emphysema, which, it has been said, is promoted by atony or paresis or paralysis of the smooth muscle fibers of the bronchia. Atony never means spasm. Nor is it necessary to demonstrate a spasm of the inspiratory muscles, for at the beginning of the asthmatic attack the patient has difficulty only in expiration, which means that through a paralysis of the dilator muscles the others gain mastery and contract. Later on during the attack, when the lungs become overdistended, there is difficulty in inspiration as well. It has been found, however, by fluoroscopic examination, that the lungs do not expand and that the diaphragm remains stationary. This is an important finding, as the diaphragm under normal conditions is the main factor in inspiration, a factor that has been eliminated entirely through atony or paresis or paralysis in an acute attack of asthma.

A similar view of the etiology of asthma is expressed by Spolverini⁸⁶ in his tendency to ascribe the cause of asthma in children to a deficient functioning on the part of the sympathetic system innervating the smaller bronchi. This paresis of the sympathetic nerves allows the vagus to act unopposed, although in reality the vagus is normal. This assumption is sustained by the favorable action of epinephrin in asthma, as this does not paralyze the vagus but merely stimulates its sympathetic antagonist. He calls attention to the lymphatic status so commonly seen in asthmatic children and to the nervousness and uricacidemia noted almost constantly in one or both parents. Great benefit is derived from suprarenal administration, even outside the attacks of asthma. Iodine, calcium and mineral waters have also proved of benefit and these children, more than any others, are helped by a return to nature.

In a series of 100 cases of asthma treatment with the protein to which they were sensitive, Walker⁸⁷ states that in 75 per cent. relief was afforded. Machado⁸⁸ emphasizes the necessity for putting an end to the predisposition which brings on the attacks of asthma and in his experience iodides and emetine have proved of value. He considers that the iodides act on the structure and the functioning of the cells while the emetine regulates the apparatus of the internal secretions. He gives

⁸⁶ *Pediatricia*, October, 1918.

⁸⁷ *Archives of Internal Medicine*, October, 1918.

⁸⁸ *Gazeta med. da Bahia*, September, 1918, vol. 1, p. 97.

the emetine by injection of 0.04 gm., increasing by 0.01 gm., per day until the dose is 0.08 gm.—a total up to 0.30 gm. in the course of five or six injections. After this he gives a course of sodium iodide by intravenous injection. By this method he claims there have never been any recurrences, and in some the interval of three years has elapsed.

ESOPHAGUS.

Spasm at the Entrance to the Esophagus. A. Brown Kelly⁸⁹ discusses the dysphagia produced by spasm at the entrance to the esophagus, which, with its definite train of symptoms, is not uncommon in middle-aged women; the pathology of which, however, has never been satisfactorily explained. There is a history of some dysphagia for years, and occasional attacks of choking. The dysphagia, with periods of intermission, gradually increase, and the choking attacks become more frequent until they are a constant accompaniment to the swallowing act. There are sensations of constriction at the level of the larynx, frequent catching of small particles of food at this level with distressing efforts to dislodge them; regurgitation of fluids on attempting to wash down the impacted body; nervousness in regard to eating, especially in the presence of strangers, and preference to have meals alone and at leisure. No history of burning the throat with hot fluids can be obtained. There is often a markedly increased flow of saliva, and the corners of the mouth are often cracked due to saliva trickling out during sleep. The patients are often anemic, and have complained of dyspepsia, and many are decidedly neurotic. Others show these symptoms only after the dysphagia has been established.

The cause of the condition is by no means clear. Hysteria is excluded by Kelly through its intermittence of symptoms and the presence of the other stigmata. A few of the patients are neurotic. The frequency of spasm and cancer of the hypopharynx in women is striking, and suggests a possible predisposition in women to lesions in this region. In his experience, cancer at the mouth of the esophagus occurred in 75 per cent. of his cases in women, while of those occurring elsewhere in the esophagus, 80 per cent. were in men. The frequency of the onset of the dysphagia following the lodgment of a foreign body suggests injury in this situation as the primary cause. Jackson has observed many times spasm of the esophagus resulting from lesions that produced no sensation themselves. A disturbance of the Auerbach (motor), Meissner (sensory) nerve plexus may so complete a reflex arc, which, having for its initial stimulus a foreign body, a fissure of local inflammatory lesion, may be perpetuated in recurring spasm, as Jackson states, by nerve-cell habit. We must also remember that cancer of the esophagus may be first evidenced by spasm at either of its orifices.

Patterson⁹⁰ calls attention to the association of a superficial glossitis, with a similar dry and thinned condition of the mucosa of the pharynx

⁸⁹ *Journal of Laryngology, Rhinology and Otology*, London, August, 1919, vol. xxiv, p. 285.

⁹⁰ *Journal of Laryngology, Rhinology, Otology*, London, August, 1919, vol. xxiv, p. 289.

and hypopharynx, with this condition of spasm of the mouth of the esophagus. Pathological examinations of portions of the mucosa removed from the tongue show a thinning of the superficial layer and an infiltration of the underlying tunica propria. He suggests that this may account for a lack of resiliency, which may increase the difficulty in the passage of food.

This lack of resiliency of the mucosa makes it imperative that great care be used in examining the parts with the esophagoscope, for but slight force serves to break the mucous coat and perforation of the esophagus may easily result.

No relation of the condition to syphilis, either by the Wassermann or therapeutic tests could be made out.

Postoperative Hematemesis. Following abdominal operations or during illnesses of very severe infective or toxic nature, the vomiting of blood may result from erosions or ulcerations of the esophagus. These are usually situated in the lower portion of that organ, and are thought to be due to digestive action of the gastric juice which had escaped into the esophagus and because of the patient's weakened condition could not be expelled. Pringle and Teacher⁹¹ cite 18 clinical cases, most of them occurring in abdominal conditions, but stomach operations are excluded. In 1 case the vomiting occurred before operation. In a series of 15 cases seen in the postmortem room, numerous submucous hemorrhages, with here and there erosions of the mucosa over them were seen. The condition may vary from superficial erosions to complete perforation of the esophagus. That the condition occurs during life, and is not simply a postmortem change, is shown by the presence of the submucous hemorrhages. One patient complained of retrosternal pain before death. Eleven of the 15 cases had had hematemesis; 6 of the cases had not been operated upon, but all had been very toxic.

The possibility of this condition arising would suggest the administration of alkalis in illnesses of severe toxic nature, in order to neutralize the hydrochloric acid and prevent the activation of the pepsinogen of any gastric juice which might be contained in the esophagus.

Paralysis of the Esophagus. Two cases of paralysis of the esophagus of sudden onset due to occlusion of the right posterior inferior cerebellar artery probably the result of arteriosclerosis, are reported by McNaught.⁹² He suggests that when confronted by a case of sudden inability to swallow, the syndrome of occlusion of the posterior inferior cerebellar artery should always be kept in mind.

Esophageal Diverticulum. Our English friends consider the term esophageal a misnomer since in most of their studies the diverticulum has been found to be a hernia of the mucosal layer between the circular and longitudinal fibers of the inferior constrictor muscle of the pharynx. It may, perhaps, be better to accept their term "pharyngeal diverticulum" for in all the cases observed by the reviewer the pouching occurred above that specialized portion of the inferior constrictor muscle which we term the cricopharyngeus. These diverticula are seen

⁹¹ British Journal of Surgery, April, 1919, vol. vi.

⁹² California State Journal of Medicine, October, 1919, vol. xvii, p. 376.

most frequently in men between the ages of fifty and seventy-five who usually give the history of bolting their food. These patients complain of sense of fullness in the neck when eating, dysphagia, and the regurgitation of undigested food particles after a meal. There is often a gurgling in the sac and patients learn that the unpleasant sensations can be relieved by pressure on the side of the neck, which causes the sac to empty. Coughing and choking attacks often interfere with sleeping and are a result of an overflow of the contents of the sac into the larynx. As the sac grows larger, dysphagia progressively increases, the sac first filling then, by its distention, causing a pressure stenosis of the esophagus. Emaciation in some of the cases is extreme and the relief afforded by operation great. Francis T. Stewart (unpublished data) has demonstrated that by having the patient close the mouth, and close the nares with the thumb and index finger, the condensed air in the pharynx dilates the sac and causes a bulging on that side of the neck, when a forced expiration is made. On percussing the bulging in the neck in this adapted Valsalvian maneuver, a tympanitic note is elicited. The sac sometimes is of considerable size (holding a pint), the contents becoming foul through retention and saprophytic decomposition. Diagnosis is usually made by radiographic examination and the esophagoscope.

Mosher has recently devised a new endoscopic method of treatment which consists in dividing the common wall between the diverticulum and the esophagus or pharynx. The primary step is to locate the opening of the pouch and also that of the esophagus, which is best accomplished under ether with a "ballooning" esophagoscope. With scissors the wall is divided to within one-eighth of an inch of the bottom, this small rim being left to avoid opening the mediastinum. In 3 cases a clinical cure resulted. In the larger diverticula, which themselves invade the mediastinum, it is evident that this method would not be applicable. Hill⁹³ reports good results from the open operation, in which the sac was dissected free and the fundus of the unopened pouch stitched to the left side of the inferior constrictor muscle. Davis and Waggett⁹⁴ mention a case done five years previously, in which the sac was inverted into the pharynx and the slit-like opening on its outer aspect stitched up. The patient, however, sneezed violently eight months after the operation and out came the pouch with recurrence of the symptoms. Halsted (quoted by Davis) ligatured the sac near the wall of the pharynx and allowed it to lie in the neck wound which was then packed with gauze. The patient, however, died with pneumonia. The two-stage operation is recommended by Mayo. In this operation the unopened sac is dissected free, the skin edges are sutured to the esophagus at its junction with the diverticulum, and the sac is left outside of the neck in the dressings. After ten or twelve days, when adhesions have formed about the sac, it may be excised without an anesthetic, and the edges inverted into the esophagus. The most satisfactory operation, however, in the hands of the reviewer and his surgical confrères, is the so-called Jackson-Gaub operation.⁹⁵ The sac is exposed through external incision

⁹³ Journal of Laryngology, Rhinology and Otology, London, July 1919, p. 249.

⁹⁴ Ibid.

⁹⁵ Peroral Endoscopy and Laryngeal Surgery, Jackson, 1914.

by the surgeon, its extent and outline is shown by the esophagoscope. The esophagoscope is then withdrawn and the sac dissected free, after which the esophagoscope is inserted into the lumen of the esophagus, the sac cut off, and the cut margins sutured over the tube. The neck wound is closed and a small drain inserted. Intratracheal anesthesia is of greatest convenience and prevents postoperative pneumonia. Rectal feeding is carried on for a number of days and usually suffices. If the patient, however, is in poor condition through chronic starvation and lack of water, preliminary gastrostomy may be urgent and necessary. Gastrostomy favors uncomplicated healing of the esophageal wound by allowing absolute rest of that organ.

Dilatation of the Esophagus without Anatomical Stenosis. A rather extensive discussion on the so-called idiopathic dilatation of the esophagus is reported in the Proceedings of the Royal Society of Medicine, London, March, 1919, vol. xii, p. 33 (Section of Laryngology). In this condition there exists generally a normal potential lumen of the gullet at the phrenic level, and immediately below it, in combination with a functional stenosis and arrest of food at the phrenic level, and ectasia above. In some of the cases the cause of the stenosis is obvious, as in hernia or eventration of the diaphragm, in which the stomach assumes a position higher than normal, thus producing angulation or kinking of the subphrenic esophagus. Hour-glass constriction of the stomach and marked pyloric stenosis are also cited as causes.

By some, dilatation of the esophagus is thought always due to obstruction in the phrenocardiac segment of the esophagus brought about by muscular action or overaction, the so-called cardiospasm. Jackson was the first to call attention to the fact that the stenosis was situated at the hiatal esophagus and not at the cardia, and substituted the term, "phrenospasm" or "hiatal esophagismus." The correctness of the observation has been long since confirmed although the term cardiospasm still persists and is used in a rather loose way.

Hill suggests the condition may result from a neuromuscular paresis and absence of coördinate active opening up of the phrenocardiac gullet during the act of swallowing, a sort of localized neuromuscular "block." "Suprahiatal hyperesthesia" is a term suggested by A. Brown Kelly to substitute that of cardiospasm, for it has been his observation that the mucosa at and near the hiatus was hypersensitive and its contact with the esophagoscope caused a closing of the hiatal esophagus, which remained closed until the tube was withdrawn a few centimeters when the rhythmical opening and closing of the epicardia recommenced.

The spasm theory is opposed by the fact that anatomically there is no hypertrophy of muscular tissue in esophagectasia, such as is found in the case of similar condition of the pylorus. Shattock suggests the possibility of there being not a hyperesthetic but a hypesthetic state of the esophageal mucosa and an incoördination of the esophageal musculature. The older authorities consider the condition to be a sort of myasthenia, or diminished contractile power of the musculature. Harbitz,⁹⁰ in describing the clinical and autopsy findings in 3 cases,

⁹⁰ Norsk Mag. f. Lægevidensk., August, 1918.

states that all seemed the result of some congenital abnormality, possibly a tendency to functional atony of the walls with abnormal conditions in the vagus innervation causing spasmodic contraction. He classes idiopathic dilatation of the esophagus with Hirschsprung's disease and the hypertrophy of the pylorus in infants.

The symptoms of the condition are intermittent dysphagia, later regurgitation is added, and the patient may complain of pressure or pain in the chest from the pressure of the filled esophagus which in some cases may hold two quarts. It is exceptional to find marked and dangerous emaciation, though a few patients have become aphagic for longer or shorter periods of time. A mouldy taste is complained of and the patient often speaks of regurgitating food eaten a few days previously.

In the cases of phrenospasm the treatment consists in dilatation, either by the mechanical dilators of Abbrand, Mosher, Lerche, or Brünings, or by stretching the lower esophagus by means of silk-covered rubber dilating bags of increasing size, as devised by Russel,⁹⁷ and used with such good success by Plummer.

Frequent washing out of the dilated esophagus with a rubber stomach-tube tends to allay the esophagitis and it has been advocated that feeding be carried on through the stomach-tube.

CANCER.

Radium Treatment. By the further development of the technic in the application of radium, we may hope for brilliant results in the treatment of cancer of the air and food passages. Freer⁹⁸ has constructed a needle placer for inserting into the tissue to be treated the steel and platinum gold-plated, hollow, radium-carrying needles devised by Simpson. Janeway, by the use of radium emanations contained in capillary glass tubes, has attained some hopeful results by burying these tubes permanently in and about the growth. An analysis of the radium treated cases reported by Greenough⁹⁹ shows that the most favorable results were obtained in superficial cancers, as those on the lip. In cancer of the palate, tonsil, buccal mucosa, lower jaw, antrum and upper jaw, none was cured. There was, however, definite benefit from radium in the lower jaw cases. In cancer of the tongue and floor of the mouth there was some retardation of the progress of the growth. It was found that leukoplakia was influenced only by actual caustic action of radium.

Lannois, Sargnon and Moutet¹⁰⁰ are more optimistic in their reports. They claim a clinical cure by the use of radium in 6 of 16 cases of malignant tumor of the tonsil; in nearly all of 6 cases of cancer of the nose; in 4 of the nasopharynx and in 2 of 3 ear cancers; sarcomata were the ones most favorably influenced. Epitheliomata proved more persistent; and as cancer of the larynx is usually of this type, they had only 3 successful cases in their 14 treated. The soft ulcerating epitheliomata are the most refractory. Their method is to use as large a dose as possible

⁹⁷ British Medical Journal, 1898, vol. i, p. 1450.

⁹⁸ Laryngoscope, December, 1913, vol. xxviii, p. 915.

⁹⁹ Boston Medical and Surgical Journal, May 2, 1918.

¹⁰⁰ Bull. de l'Acad. de méd., Paris, 1919, vol. lxxxi, p. 638.

from 30 to 120 mg. of radium bromide, leaving the tube in place at least twenty-four hours, sometimes thirty-six or even forty-eight hours. If a second application is necessary, they postpone it as long as possible on account of the danger of burns. One boy of twelve, with a fibrosarcoma of the nasopharynx, was given three exposures in two and a half months. Two months after the last application, after all traces of the tumor had disappeared, perforation of the hard palate occurred. This was the only grave complication in their experience, but in 3 cases of epithelioma of the tonsil the uvula dropped off. It was found necessary to reduce the dose for the larynx because of the danger of gangrene.

Cancer of the esophagus, while not cured, is often much retarded by the use of radium, either by exposure through the chest wall or by application through the esophagoscope. Botey¹⁰¹ finds adenomatous growth the most amenable form of cancer to radium therapy.

Concerning the use of *radium in the treatment of ear diseases*, Harris¹⁰² states after an extensive study, "We regretfully are forced to the conclusion that radium, up to the present time, has failed to be of any considerable benefit in the treatment of diseases of the ear. So far as chronic deafness is concerned, it has proved virtually a failure. In the rare cases of intractable tinnitus and excessive vertigo, on the other hand, it can be employed with reasonable hope of relief by its power of destroying the labyrinth. Finally, so far as malignant growths are concerned, it is of value when they are superficially seated. When deep-seated there is nothing sufficiently encouraging to warrant its use to the exclusion of operative measures where they can with propriety be carried out. The work that has already been done with it on the ear is not enough to condemn it, 'in toto,' however, and it is to be hoped other investigators will take it up and give it further thorough and careful trial."

Operative Treatment of Cancer. CANCER OF THE TONSIL. By a combined external and internal operation, McCoy¹⁰³ believes that in early cases the cure of cancer of the tonsil can be obtained. He makes an incision of about 2½ inches along the anterior border of the sternomastoid muscle, dissects out the glands overlying the jugular, ligates and cuts the facial vein, then ties off the external carotid artery. The dissection is continued up the neck until the posterior belly of the digastric muscle comes into view. This muscle with the stylohyoid and styloglossus are then pushed aside and the superior pharyngeal constrictor is then exposed. The field of operation is then changed to the throat. Through the mouth the tonsil and infiltrated areas are thoroughly dissected out. An incision is made through the superior constrictor in the neck, enabling the removal of any further infiltrated tissue, which is especially to be looked for at the base of the tongue. The wound in the neck is partly closed by retaining sutures, after packing with gauze, and the wounds in the pharynx allowed to heal by granulation. In cases where the infiltration is extensive, it is better to have the patient first

¹⁰¹ Rev. Espanola de med. y cirurg., December, 1918.

¹⁰² Annals of Otolaryngology and Rhinology, 1918, vol. xxvii, p. 986.

¹⁰³ Laryngoscope, July, 1919, vol. xxix, p. 422.

treated by radium injections through which the tumor seems to lose its malignancy and an operation after this is said by McCoy to offer a good prospect of recovery.

Cancer of the Pharynx and Larynx. Vandenwildenberg¹⁰⁴ considers that cancer of the hypopharynx and larynx should be treated by radical laryngopharyngectomy and later plastic reconstruction of the hypopharynx and upper esophagus by flaps. It is his opinion that these extensive operations are indicated if only to ensure the nutrition of the



FIG. 54.—Hoshino's method of voice production after laryngectomy. The tube can be carried in the pocket; when it is used one end is attached to a piece of metal tubing which just fits in the tracheal cannula, while the other is held in the mouth; in this way air is forced into the pharynx. Thus, with the help of the lips, teeth, tongue, palate and pharyngeal muscles, a whisper can be produced.

patient by way of the esophagus. Gastrostomy he much deprecates as a dangerous operation which condemns the patient to liquid diet, without the comfort of mastication and taste, until his death. Seven cases are reported, all having more or less extensive malignant growths involving both the larynx and upper esophagus. The ages varied from fifty-four to seventy. One case lived for three years and finally died from lymphatic glandular metastatic involvement. The other 6 died within eight hours to ten months after the operations.

¹⁰⁴ Rev. méd., Louvain, April, 1919, p. 81.

CANCER OF THE LARYNX. Laryngectomy is again being practiced extensively and excellent results have been reported by Arrowsmith, MacKenty, McCoy and others. In properly selected cases, in which the extent of the involvement is not too great and the general condition of the patient good, lasting results may be obtained by laryngectomy.

Hoshino¹⁰⁶ reports excellent results in 16 cases of laryngectomy, 8 had recurrence of the growth, the other 8 were well after from three to four years' interval. He finds local anesthesia quite satisfactory. For purposes of conversation he has the patient use a rubber tube, one end of which is inserted into the tracheal cannula and the other end into the mouth. During expiration sufficient air is carried to the mouth to produce a whispering buccal voice (Fig. 54). In one of MacKenty's cases the patient had acquired the knack of swallowing air, this he released as required and produced a loud buccal voice.

Generally considered, however, mutilating operations are rarely justified in extensive pharyngeal and party wall malignant involvement, for the mediastinal glands are surely involved and cannot be removed. The patient will usually be as comfortable and his lease of life quite as long with gastrostomy and therapeutic use of radium and roentgen ray, as with extensive operative treatment. Gastrostomy should not be a particularly dangerous operation if done before nutrition is too seriously impaired; it can be done under local anesthesia with but little shock to the patient. Surgery remains the best method of treatment when one can be sure that all of the involved tissues can be removed. In cancer of the anterior half of the larynx, thyrotomy and excision of the growth accomplishes a cure in 85 per cent. of the cases. With extensive involvement of the posterior portion of the larynx, the lymph drainage down the party wall between the trachea and the esophagus has usually allowed a metastasis to the mediastinum. Radium and the roentgen ray are here perhaps the best form of treatment. When the condition is seen fairly early, laryngectomy is indicated, with later treatment of the chest and neck, with radium and the roentgen ray to check or prevent metastasis. The tendency of malignant growths of the posterior third of the tongue to break down and become secondarily infected has been recently called to the attention of the reviewer in a number of cases referred for diagnosis. These cases had been considered abscess of the tongue and were so treated until past all possibility of benefit. In one, a general surgeon had performed subhyoid pharyngotomy for the purpose of draining the supposed abscess. The incision was utilized for the purpose of inserting a tube of radium. Following the first exposure, the crater-like cavity in the base of the tongue completely cicatrized, but broke down later and progressed rapidly to a fatal termination in spite of radium and ray treatment.

Foreign Bodies in the Food and Air Passages. In an analysis of 628 cases, Chevalier Jackson¹⁰⁶ makes extensive observations on the *pathology* resulting from the lodgment in the food and air passages of different kinds of foreign bodies for longer and shorter periods of time; 98.1

¹⁰⁶ Annals of Otolaryngology and Laryngology, June, 1919, vol. xxviii, p. 466.

¹⁰⁶ Mütter Lecture, Surgery, Gynecology and Obstetrics, March, 1919, p. 201.

per cent. of the foreign bodies were successfully removed. Mortality was less than one-half of 1 per cent. directly attributable to the endoscopic procedure, and taking together all deaths from any cause whatever within one month after endoscopy, the mortality was 1.9 per cent.

The recovery of lung tissue from such extensive and prolonged suppurative processes as those present in some instances is very remarkable. A woman who had a glass collar button in the lung for twenty-six years, and who was toxic and extremely emaciated, weighing only 98 pounds, two years later had regained perfect health and weighed 182 pounds. The internist reported that by physical signs no abnormality of the lungs was elicited. In some of the cases of prolonged sojourn it was necessary to dilate a cicatricial stricture to gain access to the foreign body. Repetition of the dilatation of the strictured bronchus was not found necessary after the removal of the intruder although it can be easily accomplished if necessary without anesthesia.

The various classes of foreign bodies are listed under their respective headings of metal, minerals (other than metals), animal substances, and vegetable substances, and the changes they undergo while contained in the body are noted in detail. Nut kernels are supposed to disintegrate in time but no evidence of it clinically was found. The longest sojourn was one month, and even in this time a roasted peanut kernel seemed to be in about the same condition as one purchased for comparison, although some degree of swelling had probably occurred. Maize, beans, and other dried starchy substances were found to undergo no change other than swelling. This has an important pathologic bearing, because of the pressure exerted upon the tissues, and especially because of the increased interference with drainage.

The reaction of the tissues is dependent upon (1) shape and size; (2) surface qualities; and (3) composition and character of the foreign body. Marked reaction follows the complete obstruction of drainage and aëration of a bronchus, while with a foreign body of similar physical nature but of a shape that allows the passage of air and secretions, the reaction is much less. A rough and sharp foreign body, if fixed, traumatizes the tissues only in its immediate vicinity. If the intruder is knocked about by coughing, the trauma may be scattered in different localities. In children, swelling of the subglottic tissues is apt to interfere with bechic expulsion of secretion, and then diffuse reaction is usual, regardless of the nature of the foreign body. The least reaction of the bronchial tissue is caused by iron and steel, provided the invader is not of such size and shape as to obstruct the aëration and drainage. An exception may be made of pure gold and silver, but few such objects are found in the endoscopist's experience. Next in order are the dense non-absorbent mineral substances, such as pebbles, glass, imitation diamonds, etc. Iron and steel seem to start up a localized reaction very slowly. It is only after prolonged residence when the bulk of the object increases, plus swelling of the tissues, granulations and later stricture formation, that drainage becomes impaired and abscess, bronchiectasis and extensive tissue changes occur. Brass objects seem but slightly irritating if drainage and aëration are not impaired.

It is very remarkable that so septic a thing as a piece of cancellous bone can remain in the lung for a period of eleven years and not produce a fatal degree of sepsis. A boy of nine years, inhaling a piece of bone while eating soup suffered for eleven years from septic bronchitis, which had developed perichondritis, stricture and bronchiectasis. Yet the boy grew and developed until the age of twenty although he was a constant invalid and erroneously considered tuberculous. Wood sets up a high degree of reaction; while hard rubber caused but little trouble. Soft rubber, however, in the air passages caused a violent reaction, as is well illustrated in the case of a man of thirty-six, who, while in an epileptiform convulsion, bit in two and aspirated a part of a soft rubber eraser which had been inserted between the teeth to protect the tongue from being bitten. Wheezing and coughing followed and was diagnosed asthma. A number of roentgenograms failed to show the foreign body, but finally it was located by a skilful radiographer and an unsuccessful bronchoscopic attempt at removal was made. He came to Philadelphia, seven months after the accident, in moribund condition. Bilateral pneumonia, with gangrene and multiple abscess formation, was diagnosed by physical signs on his arrival and corroborated by autopsy two days later. Nut kernels, coffee berries, maize, beans and similar organic substances set up the most violent reactions, radically different from the comparatively mild reactions to metallic materials.

A distinction must be made between the location of primary lodgment and of ultimate lodgment of foreign bodies. They tend to migrate continually downward and toward the periphery of the lung. Later, pathological processes fix the object in inflammatory tissue, while the purulent processes migrate toward the pleural cavity, which they often enter. In only one case, however, had the foreign body followed the pus into the pleura. The most frequent site of lodgment was found to be at, or immediately below, the giving off of the right upper lobe bronchus. The next most frequent site was the corresponding anatomical location on the left side. Next in order of frequency were the stem bronchi, first on the right, then on the left. The dorsal branches were much more frequently invaded than the ventral, the most frequent of all being the large posterior branch of the left inferior lobe bronchus that is given off immediately below the left upper lobe bronchus.

The causes of reaction of bronchial tissues to the presence of foreign bodies is divided into (1) Mechanical. Trauma, or occlusion of a bronchus; (2) Biomechanical. Irritation due to corrosion and by incrustation of the foreign body, increased bulk by corrosion, swelling of the foreign body and swelling of the bronchial wall; (3) Chemical. Those in which the intruder contains material directly irritating to the tissues; (4) Biochemical. Reactions on the tissues produced by irritative agents developed by bacterial or tissue-cell activities; (5) Age. Observations showed that the lower air passages of infants react more severely and generally to foreign bodies than those of adults. This is especially true of the subglottic region in children less than nineteen months old. The youngest patient was eleven days old. The mere contact of a foreign body in the trachea or bronchi seems to cause little reaction. After the

foreign body has reached the trachea or bronchus practically all cough ceases until secondary inflammatory change occur.

In 23 cases in which the foreign body had been in the lung for periods ranging from three months to twenty-six years, the patients developed the clinical picture of pulmonary tuberculosis. No tubercle bacilli were found in any case. Recovery after the removal of the foreign body is the rule. When the drainage from a bronchus, large or small, becomes obstructed, the natural passages become filled with secretions which are, or soon become, purulent. This condition is designated by Jackson "drowned lung." Clinically, it differs from abscess in that it may develop rapidly, within a day or two in some instances, and in that it is at once relieved by removal of the foreign body. If, however, the area of "drowned lung" is not relieved by removal of the foreign body, the bacteria become active in the pent up secretions; the saprophytic decomposition occurs; the toxins and other products of bacterial activity, together with the inflammation, result in destruction of the cilia, the epithelium, then the subepithelial tissues, and the perichondrium; the cartilage dies and a cavity forms—a lung abscess. It is doubtful if foreign bodies contained in bronchi of the size of three millimeters in diameter ever become encysted; there being five factors which probably contribute to prevent encystment of a foreign body in the lung: (1) Infection. (2) Patency. (3) Epithelialized surfaces. (4) Movement. (5) Penning up of subjacent secretions, normal or abnormal, the passage of which maintains an open channel when forced upward either by bechic or accumulative pressure. Contrary to accepted belief, pneumonia as ordinarily understood by internists, is, in Jackson's opinion, a relatively rare sequel to the aspiration of a single foreign body.

Foreign Bodies in the Pharynx. A most unusual case is reported by Moh, Zaky Shafei,¹⁰⁷ that of a boy, aged eight years, who, while fishing in the Nile, caught a small trout and after taking it from the hook held it between his teeth while rebaiting his line. The fish wriggled into the pharynx and asphyxiated him. When seen by the reporter he was unconscious, cyanosed and breathing with great difficulty. The mouth was gagged open and after repeated attempts the fish was removed. The boy was unconscious for forty-five minutes, requiring artificial respiration, strychnine injection and other restoratives. The fish was a Nile trout measuring 6 inches long and 3 inches broad at its widest part.

Culp¹⁰⁸ reports the removal of a needle from the sublingual sinus near its attachment to the epiglottis, which was said by the patient to have entered the left knee eleven years before while she was scrubbing the floor.

Leeches in the Larynx. The lodgment of leeches in the larynx is said by Navarro¹⁰⁹ to be quite common in Andalusia and Cordova, Spain, where, during the summer months, ignorant agricultural laborers often drink hastily from ditches. He has had more than 100 of such cases personally. At the moment of deglutition the animal as a defensive

¹⁰⁷ The Practitioner, vol. ci, 1918, p. 348.

¹⁰⁸ Laryngoscope, 1919, vol. xxix, p. 292.

¹⁰⁹ Rev. hebdomadaire de laryng., Paris, 1917, vol. xxxviii, p. 290.

measure attaches itself within or about the larynx. Symptoms vary, of course, with the site of attachment. Hemorrhage by mouth is a constant symptom. Loss of blood may lead to marked anemia. According to the point of attachment, the special symptoms vary from none to imminent asphyxia. On laryngoscopic examination, the leech may be found on the edge of the epiglottis, or on its posterior surface, or either commissure, or on the cords or below them. In 1 case, a woman aged seventy years had a leech attached to the anterior commissure so that its body acted as a valve, almost preventing respiration. Navarro removed the leech with Krause's forceps and warns against cocainization, as the animal may release its hold and drop further into the larynx or trachea. The leech as a foreign body is rarely encountered in America, though it is not uncommon in ponds, marshes and streams and not infrequently attaches itself to bathers.

Arachidic Bronchitis. A peculiar form of purulent, edematous laryngo-tracheo-bronchitis, which results from the aspiration of portions of nut kernels, particularly those of the peanut, into the lower respiratory passages, is discussed by Chevalier Jackson and William H. Spencer.¹¹⁰ This is termed by the authors "Arachidic Bronchitis" and is characterized by the rapid onset of toxemia, irregular fever, dyspnea, cyanosis, paroxysmal cough and the secretion of a copious, thick, tenaceous, pinkish or grayish pus, which is with great difficulty expelled from the swollen lower air passages. The cases observed have all been in children, and the reaction is so prompt and so severe as to be often fatal in a child of less than one year within a week after the aspiration of the foreign body. There seems to be associated with the peanut, or inherent in it, a particularly toxic quality which causes this reaction, for it has never been observed to follow the aspiration of metallic foreign bodies, although similar reactions have been noted when other nut kernels, coffee berries, maize, and other vegetable substances, have been aspirated. Age is noted as a proved etiological factor. The older the child, the less severe the reaction; although, unless the peanut be removed, the result is ultimately fatal from the toxemia or lung abscess developing distal to the lodgment of the foreign body. The condition should be thought of when a child is seen who, after eating peanuts or peanut candy, suddenly develops irregular fever, dyspnea, slight cyanosis, paroxysmal cough attended with the difficult expulsion of a thick, tenacious, pinkish or grayish sputum, accompanied by a definite toxemia. All the features of this syndrome may not be present, especially in older children. The condition must be differentiated from diphtheria and the laryngo-tracheo-bronchitis occurring in influenza. If the patient be not severely dyspneic, the prompt bronchoscopic removal of the peanut will usually be followed by a subsidence of the symptoms and rapid recovery of the child. If, on the other hand, the patient be suffering from severe dyspnea due to laryngotracheal edema, tracheotomy should be done to drain the trachea and bronchi of the accumulating secretions, the absorption of the toxins from which causes the toxemia, and to pipe air to the

¹¹⁰ Journal of the American Medical Association, August, 1919, vol. lxxiii, 672.

lungs. Tracheotomy in some of the cases is a life-saving measure, preventing the little patient drowning in its own secretions and immediately resulting in a subsidence of the dyspnea which, if unrelieved, would soon produce exhaustion; but it should not be done for the insertion of a bronchoscope. After the tracheotomy wound has begun to granulate, the peanut is to be removed by bronchoscopy through the mouth. The tracheotomic wound may in a few days be allowed to heal.

Asthmatoid Wheeze—Diagnostic Sign of Bronchial Foreign Body. The difficulties encountered in diagnosing the presence of a foreign body in the air passages when it fails to make a shadow in the ray plate, render each sign and symptom of value in deciding whether to do, or not to do, a bronchoscopy. Chevalier Jackson¹¹¹ has described a new diagnostic sign of invaluable aid in some of these problematic cases and which he terms the "Asthmatoid Wheeze." This is a wheezing heard by placing the ear, not at the chest wall, but at the patient's open mouth and requesting a complete expiration. It seems to be of a dryer quality than that of asthma and is most pronounced when the air passages are coughed free from secretions. It is of no localizing value as to which bronchus is invaded; the wheezing is, however, louder when the intruder is lodged in the trachea. The mechanism of production is probably the narrowing of the tracheal or bronchial lumen by an irregular object which causes the formation of sound waves in the side currents when the air passes the obstruction. In those cases in which the bronchus is completely occluded by the foreign body, the wheeze is not found. It is characteristic of the asthmatoïd wheeze that after the removal of the foreign body the wheeze immediately disappears.

Coins in the Air Passages. Of 37 cases of coins in the air passages assembled by Moore¹¹² from the British literature of the period between 1819 and 1915, nearly a century, 22 were impacted in the larynx, 3 in the trachea, 9 in the right bronchus, 1 in the left bronchus, while the remaining 2 were stated to be in a bronchus. Seventeen were coughed up (8 assisted by inversion), and 2 were coughed up into the mouth, swallowed and later evacuated per anum. Death occurred in 4 cases—from pulmonary tuberculosis in 3 cases, and apoplexy in 1 case. Thyro-fissure was performed in 3 cases. Laryngeal forceps were used in 6 cases, no attempts at removal were made in 2 cases; successful peroral endoscopy was employed in 3 cases. The longest sojourn of a coin in the larynx was six years, and in the bronchus, ten years. Only 4 deaths in 37 cases when compared with the high mortality reported in the cases in which coins have become impacted in the esophagus, is considered by Moore to be due to the inaccessibility of the respiratory tract to the coincatcher, bougie and probang, and their consequent safety from the rough treatment generally meted out to the esophagus. The statement that 3 of the cases in which the coins had invaded the bronchi died from pulmonary tuberculosis is noteworthy. In the older treatises before the discovery of the bacillary origin of tuberculous processes, it is stated that the foreign body predisposes to the development of tuberculosis

¹¹¹ American Journal of the Medical Sciences, 1918, vol. clvi, p. 625.

¹¹² Lancet, September 27, 1919, p. 609.

and that death is usually due to this secondary infection. The tradition has been handed down to the text-books of today. In the experience of Chevalier Jackson,¹¹³ tuberculosis has never been found associated with the lodgment of foreign bodies in the air passages, although many of the cases had been diagnosed and treated for the disease. Jackson states that though the clinical picture of tuberculosis is often complete, even to the hemoptysis, the absence of bacilli proved the condition not tuberculous, and recovery after the removal of the foreign body was more rapid than in tuberculous patients. Lung abscess and bronchiectasis he found to be the lesions caused by the intruder, and, if death occurs, it is usually the result of chronic sepsis, or perhaps hemorrhage from the erosion of a vessel in the abscess walls.

An interesting account of the lodgment of a cent in the left bronchus for a period of eleven years is reported by Holmes.¹¹⁴ Bronchoscopy under local anesthesia was done and the edge of the coin could be seen protruding from a pocket in the posterior wall of the left bronchus when the patient coughed, but with the forceps at hand it could not be removed. On the following day, armed with selected forceps, a firm grasp of the coin was obtained, but the opening of the sinus was surrounded with such firm fibrous tissue that it was deemed unwise to exert too much traction because of the risk of tearing the normal lung tissue. Further effort was postponed. Two days later the patient stated that he had carried the cash with him for eleven years and hated to think of being reduced to going without a copper. The symptoms and purulent expectoration began to subside, however, and after three weeks there was scarcely any cough and but scant secretion. Before leaving the hospital a radiograph was taken and to the surprise of all, no evidence of the coin could be found. It is quite evident that the gentle and careful manipulation had dilated the orifice of the sinus and allowed the escape of the coin into the bronchus from which it was subsequently expelled. Holmes is to be commended for the skill, caution and good judgment exercised in the handling of the case. Doubtless had he not loosened the foreign body it would not have been coughed up and would ultimately have proved fatal. Of all aspirated foreign bodies known to have lodged in the lower air passages, only about 2 per cent. have been coughed up.

Dental Objects in the Air Passages. The dentist's contribution to the foreign body question has recently been the subject of much comment. St. Clair Thomson¹¹⁵ reports *in extenso* the case of a healthy girl, aged ten years, in whom, four weeks after the extraction of teeth, there developed cough, and a wheeze which was audible some distance from the patient, together with other signs of lung infection. Radiographic examination showed a tooth in the depths of the left lung. Two peroral bronchoscopic attempts under chloroform anesthesia at an interval of eight days between the operations, were unsuccessful, although the foreign body could easily be brought in the line of bronchoscopic vision. A later

¹¹³ Surgery, Gynecology and Obstetrics, March, 1919.

¹¹⁴ Annals of Otology, Rhinology and Laryngology, 1919, vol. xxviii, p. 55.

¹¹⁵ Proceedings of the Royal Society of Medicine (Odontology Section), July, 1918, p. 100.

radiograph showed the tooth at a lower level and the formation of an abscess distal to the foreign body. Three weeks after the second bronchoscopy a tracheotomic bronchoscopy was done under chloroform anesthesia, the tooth this time being readily grasped and removed. An uneventful and complete recovery followed. Shurly¹¹⁶ cites cases in which he removed a tooth, a piece of hard rubber from a dental mouth gag, and a dental burr. As Hubbard¹¹⁷ truly says, most of the dental objects go into the intestinal tract. He reports the interesting case of a nurse, who, while taking dental treatment, developed violent abdominal symptoms which were attributed to the possible lodgment in the appendix of a dental burr which had been lost during one of her sittings. Appendectomy was done but no burr found. He mentions the spontaneous expulsion of a tooth which had been in the lungs for several years; and in a third case Hubbard removed a fragment of dental cement which had been in the left lung for seven months and had caused the symptoms of advanced tuberculosis. Harmon Smith¹¹⁸ recalls the lodgment of a dental burr in the upper left lobe far out to the periphery. This patient succumbed to the operation of thoracotomy. Getchell¹¹⁹ adds 2 cases to the list of aspiration of teeth into the lung. Munger¹²⁰ attempted to remove by tracheotomy a dental burr which had lodged just below the vocal cords. No dental burr was found, but it dropped the next morning from the nasopharynx and was expectorated. It is probable that during the anesthesia for the tracheotomy the broach had been coughed into the nasopharynx. Mayer¹²¹ removed a gold crown from the bronchus. Lynch¹²² removed nine pieces of plaster of Paris from both lungs, which had been aspirated at the time the dentist had been taking an impression. Friedberg¹²³ divides these accidents into those that occur at the time of operation, and those that result later from insufficiently attached crowns and bridges. He illustrates this classification by the citation of the bronchoscopic removal of a tooth which had been aspirated during extraction and a second case in which an intoxicated man loosened a bridge of three teeth and aspirated it into the left bronchus from which it was removed. He speaks of a third case in which an aspirated dental broach was fortunately coughed out several days after the accident. Delavan¹²⁴ states "in looking over a long series of these cases it seems to me, that unless the bronchoscope will succeed in removing the foreign body, the patient's chances of life are better if time is given before placing him in the hands of a surgeon, than if placed at once in the hands of a surgeon and a radical operation for the removal of the foreign body performed promptly."

Chevalier Jackson has within the last few months removed a gold crown, a three-toothed bridge, an amalgam filling, a tooth and two dental broaches from the bronchi which had found their way into the air passages while the patients were in the dental chair. Seven previous cases of dental broaches in the lung¹²⁵ point to the broach of this particu-

¹¹⁶ Proceedings of the American Laryngological Association, 1917.

¹¹⁷ Ibid.

¹¹⁸ Ibid.

¹¹⁹ Ibid.

¹²⁰ Ibid.

¹²¹ Ibid.

¹²² Ibid.

¹²³ Ibid.

¹²⁴ Ibid.

¹²⁵ Chevalier Jackson and William H. Spencer: *Dental Cosmos*, March, 1919.

lar kind (root canal reamer) as especially prone to reach the lungs if lost from the dentist's fingers.

A study by Guthrie¹²⁶ of 57 foreign bodies removed from the food and air passages shows a number of interesting cases. The sojourn of a piece of rabbit bone measuring 14 by 21 mm. for eighteen months in the larynx of a girl, aged eleven years, without producing sufficient reaction to completely cut off the airway is remarkable. After removal by direct laryngoscopy, the symptoms of laryngeal stridor gradually disappeared. Twelve of the cases of esophageal foreign bodies were tooth plates. Three of these cases were rid of their foreign body by cervical esophagotomy. A case is mentioned in which a coin was regurgitated from the stomach into the esophagus and subsequently removed by esophagoscopy. The danger of blind attempts at removal is illustrated by the finding of a coin buried under the mucosa of the posterior wall of the lower pharynx after an attempt at removal had been made with a coin catcher. Fortunately, the patient made a good recovery.

Ellen J. Patterson¹²⁷ brings out the point that in most cases of foreign body extraction anesthesia, local or general, is unnecessary. In practiced hands the duration of the operation is very short, and, while unpleasant, cannot be said to be painful. The dangers of narcosis are avoided. The only fatal result was in a child of two and one-half years who had aspirated a bean thirty-six hours previously and was admitted to the hospital with deep cyanosis, temperature 102.8° F., pulse 200, respirations 70. Tracheotomy was performed but failed to relieve the dyspnea. The mucosa of the trachea was found to be so swollen that a 4 mm. bronchoscope could not be passed. This marked reaction to the presence of organic substances in the bronchi is fully in accord with that observed by the reviewer and is most markedly seen in the aspiration of peanuts, as described under arachidic bronchitis (q. v.) Twenty-two interesting cases of foreign bodies in the food and air passages are recorded.

One hundred and eleven cases of foreign bodies impacted in the food and respiratory passages have been reported in the Proceedings of the Royal Society of Medicine, London, Section of Laryngology in the decade 1908 to 1918. These have been analyzed by Moore¹²⁸ to show the following outstanding points: *Food Passages*. Three were in the pharynx. One was extracted by esophagoscopy and two by suspension laryngoscopy. Fifty-three of 60 patients who had foreign bodies in the esophagus recovered, 7 died. In the 53 recoveries, the foreign body was successfully removed in 47 cases. In 5, it was released by the passage of the esophagoscope and went downward. In only 1 case was the foreign body removed by esophagotomy. Two of the 7 deaths were due to previous blind use of the bougie. Two to previous ulceration and perforation into the trachea, and 1 to previous abscess and ulceration into the mediastinum. In these 5 cases the foreign body was extracted

¹²⁶ Journal of Laryngology, Rhinology and Otology, February, 1919, vol. xxxiv, p. 38.

¹²⁷ Pennsylvania Medical Journal, April, 1918.

¹²⁸ Proceedings of the Royal Society of Medicine (Laryngology Section), December, 1918, vol. xii, p. 14.

before death. No death could be attributed to the use of the esophagoscope.

Respiratory Passages. In 8 cases of foreign body in the larynx, 6 were extracted by direct laryngoscopy, and 1 by suspension laryngoscopy. In 1 case, which had been diagnosed and treated for diphtheria, a collar stud was found postmortem in the larynx. Of 3 foreign bodies in the trachea, 2 were extracted by peroral endoscopy, and 1 through a tracheotomic incision. There were no deaths. Of 36 foreign bodies in the bronchi, 29 were extracted by peroral bronchoscopy and only 2 by tracheobronchoscopy. Three were spontaneously expelled during coughing, 1 through the bronchoscope. In 1 case thoracotomy was successfully performed. There were no deaths in this series. From these statistics, the success of carefully performed endoscopy is strikingly demonstrated and the now well-known dangers of blind bouginage of the esophagus are again proved.

Foreign Bodies in the Esophagus. Seven cases of impaction of tooth plates are reported by six eminent laryngologists in the Proceedings of the Royal Society, Section of Laryngology, December, 1918, vol. xii. In 2, the tooth plate was divided by Moore's shears, the portions slipped down into the stomach and were expelled per rectum. Two others were removed entire by esophagoscopy. In 1 case death followed from perforation into the pleural cavity eight weeks after the accident. Three unsuccessful attempts at removal had been made. Esophagotomy was performed in 2 cases, 1 of which died. A mortality of 28 per cent. in this series of cases. Callison¹²⁹ reports the removal of a dental plate from the esophagus by esophagoscopy with excellent recovery.

Doolittle¹³⁰ cites the passage of an open safety pin which had been swallowed six weeks previously and which by roentgenographic study was known to have remained in the stomach for four weeks. The retention of foreign bodies in the stomach in adults for years is not uncommon. Chevalier Jackson (unpublished data) recently removed an open safety pin from the esophagus which had been regurgitated from the stomach into the esophagus where it was producing dangerous symptoms which immediately subsided after the removal of the safety pin. The pin had been in the stomach for two months.

The reviewer takes this opportunity to again emphasize the importance of not changing the diet of the infant and of not administering purgatives to patients who have swallowed foreign bodies. Even in breast-fed infants, an open safety pin will be found imbedded in the center of a quantity of feces if nature is allowed to manage the situation. Cathartics liquify the feces and a change in diet, especially in infants, is prone to set up a gastro-enteritis and diarrhea which defeats nature's efforts to surround and protect the pointed object with the contents of the intestine.

¹²⁹ Laryngoscope, December, 1918, vol. xxviii.

¹³⁰ Journal of the American Medical Association, 1919, vol. lxxiii, p. 35.

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